Repair Manual

Golf, Jetta, Jetta Wagen 2010 ➤

Generic Scan Tool								
Engine ID	CJAA							

Edition 09.2023

List of Workshop Manual Repair Groups

Repair Group

ST - Generic Scan Tool

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

Contents


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ST – Generic Scan Tool

1 General Information

(Edition 09.2023)

Included in the contents of this Generic Scan Tool (GST) manual is a summary table of the vehicle specific OBD II Emission Related DTCs. The DTC table contains DTC Malfunction Criteria, Threshold Values, Secondary Parameters, Enabling Conditions, Monitoring Time Length, Frequency of Checks, and MIL Illumination information which can be used to accurately monitor and diagnose emissions related faults and perform functions required to run Modes 01 through 0A (if applicable) with a hand held scan tool.

This manual also contains the step by step procedures to accurately diagnose and repair a component or system once a DTC has been set. References to repair procedures and wiring diagrams can be found within the diagnostic test procedures.

- ⇒ “1.1 Safety Precautions”, page 2
- ⇒ “1.2 Clean Working Conditions”, page 4

1.1 Safety Precautions

Check for Technical Bulletins that may supersede any information included in this manual.

WARNING

Failure to follow these instructions may result in personal injury or possible death.

Check the Technical Bulletins for information, cautions and warnings that may supersede or supplement any information included in this manual.

When performing the drive cycle operation, pay strict attention to driving conditions and observe and obey all posted speed limits.

Test equipment must always be secured to the rear seat and operated by a second person. If test and measuring equipment is operated from the passenger seat, the person seated could be injured in the event of an accident involving deployment of the passenger-side airbag.

The fuel system is under pressure! Before opening the fuel system, place rags around the connection area. Then release pressure by carefully loosening the connection.

The engine section of the fuel system, after the high pressure pump, is under extremely high pressure! When working on engine or fuel injection system, fuel pressure must be relieved to residual pressure before opening high pressure components. Refer to the Service Manual for the proper procedure.

If the battery has not been disconnected, the fuel pump fuse must be removed before opening the fuel supply system as the fuel pump may be activated by the driver's door contact switch.

Testing of the EVAP and ORVR systems can result in the escape of explosive fuel vapor. Do not smoke while testing the EVAP system, and make sure the area you are working in is well ventilated.

Observe the following for all procedures, especially in the engine compartment due to lack of room:

- *Route lines of all types (e.g. for fuel, hydraulic, EVAP canister system, coolant and refrigerant, brake fluid, vacuum) and electrical wiring so that the original path is followed.*
- *Watch for sufficient clearance to all moving or hot components.*
- *Do not touch or disconnect the Ignition Coils, ignition wires, connecting parts or adapter cables when the ignition is on or the engine is running or turning at starting RPM.*
- *Only disconnect and reconnect wires for injection and ignition system, including test leads, when the ignition is turned off.*

When removing and installing components from full or partially full fuel tanks, observe the following:

- *The fuel tank must only be partially full. How much fuel can remain in the fuel tank may be read in the respective work description. Empty the fuel tank if necessary.*
- *Before starting work, switch on the exhaust extraction system and place an extraction hose close to the installation opening of the fuel tank to extract escaping fuel fumes. If no exhaust extraction system is available, a*

radial fan (as long as motor is not in air flow) with a displacement greater than 15 m^3/h can be used.

- *Prevent fuel from contacting the skin! Wear fuel-resistant gloves!*

When servicing the engine control module (ECM), it may be necessary to use a heat gun. The heat gun, shear bolts, and parts of the protective housing will become extremely hot. Use extreme caution when working with or handling these parts to avoid personal injury.

Observe operating instructions when working with a heat gun. To prevent damage (burning) to the wiring and harness connections, insulation and the electronic components, perform outlined work steps exactly!

The cooling system is under pressure. To avoid scalding, use caution when opening the cooling system and servicing cooling system components!

Caution

The battery must only be disconnected and connected with the ignition switched off. Otherwise, the engine control module (ECM) can be damaged.

The use of nails, paper clips, or another unauthorized materials to back-probe harness connectors is strictly prohibited and may cause damage to the harness connectors, terminal ends or to a component. Use only the manufacturers test lead kit or an equivalent aftermarket test lead kit for back-probing all harness connectors.

Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be burned in the engine and will damage the oxygen sensors.

Secure all hose connections with the correct hose clips (the same as original equipment).

If engine is to be cranked without starting (for example; as part of a compression test), remove the fuses for the voltage supply of ignition coils and the fuel injectors.

An electrostatic charge can lead to functional problems of electrical components of the engine, transmission and selector lever mechanism. Touch a grounded object, e.g. a water pipe or a hoist, before working on electrical components.

Do not make direct contact with harness connector terminals.

Use only gold-plated terminals when servicing any component with gold-plated harness connector terminals.

1.2 Clean Working Conditions

Even minor contaminations can lead to malfunctions in the fuel injection system. When working on the fuel supply/injection system, pay careful attention to the following rules of cleanliness:

- Thoroughly clean all connections and the surrounding area before disconnecting.
- Place removed parts on a clean surface and cover. Use lint-free cloths.
- Carefully cover opened components or seal, if repairs are not performed immediately.

- When the system is open, do not work with compressed air. Do not move vehicle unless absolutely necessary.
- Install clean components: Remove the parts being replaced immediately prior to installation of the new parts. Do not use parts that have been stored unpacked (e.g. in tool boxes etc.).
- Electrical connectors that have been disconnected: Protect from dirt and moisture. Make sure connections are clean and dry when reconnecting.

2 Description and Operation

2.1 On Board Diagnostic Systems

On Board Diagnostics, or OBD, is an automotive term referring to a vehicle's self-diagnostic and reporting capability. OBD systems give the vehicle owner or repair technician access to the status of the various vehicle sub-systems. Modern OBD implementations use a standardized digital communications port to provide real-time data in addition to a standardized series of Diagnostic Trouble Codes (DTCs) which allow one to rapidly identify and remedy malfunctions within the vehicle. Legislation mandates a vehicle equipped with OBD-II to light up the fault indicator lamp if its emissions exceed the prevailing limit due to system malfunction.

All cars built since January 1st, 1996 (MY 1996) are equipped OBD-II systems. Manufacturers started incorporating OBD-II in various models as early as 1994; however, some early OBD-II cars (MY 1994 and MY 1995) were not 100% compliant.

2.2 Evaporative Emission System

The evaporative emission system has been designed to minimize the release of hydrocarbons from the fuel system into the atmosphere. The evaporative emission system components all work together with the ECM to prevent fuel vapor from escaping and route it to the intake manifold to be burned during normal combustion.

The leak detection system checks the integrity of the evaporative emission system by pressurizing the system.

- There are 3 different types of evaporative emission systems used. These systems are explained below.

♦ ⇒ “2.2.4 EVAP System, Checking for Leaks”, page 7

2.2.1 Leak Detection Pump (LDP) Evap System

The leak detection pump (LDP) is integrated into the EVAP system and can have two functions. The LDP can:

- ♦ Pressurize the EVAP system and detect a drop in pressure that would indicate a leak.
- ♦ Function as the EVAP Canister Vent on vehicles that do not have a separate EVAP Canister Vent.

The LDP is a vacuum-driven, ECM controlled, diaphragm pump. In order to operate, the engine must be running and vacuum applied to the Vacuum Switch.

2.2.2 Tank Leak Diagnostic Module (DM - TL) Evap System

The canister purge valve can be actively checked using the Tank Leak Diagnostic Module (DM - TL). For this purpose the electric pump is shortly activated while the combustion engine is running, to build up a minor pressure in the fuel tank and monitor the pressure decay after opening the canister purge valve. Optionally as a quick pass method, the monitoring can be carried out by passively monitoring the fuel mixture deviation when the canister purge valve is opened. If a significant fuel mixture deviation is detected, the purge valve monitor passes. The Tank Leak Diagnostic Module (DM - TL) consists of an electrically operated air pump, an orifice with a defined diameter serving as a reference leak, and a change-over valve switching the air flow between the reference leak and the tank. If neither the pump nor the change-over valve is activated, the tank is ventilated through a bypass in the module.

2.2.3 Natural Vacuum Leak Detection (NVLD) Evap System

The system utilizes an engine-off natural vacuum evaporative system integrity check that tests for leaks with a diameter of 0.020 inch while the engine is off and the ignition is off. The natural vacuum leak detection (NVLD) evaporative system integrity check uses a pressure switch to detect evaporative system leaks. The correlation between the pressure and the temperature in a sealed system is used to generate a vacuum in the tank when the temperature drops. If a sufficient temperature drop is detected for a minimum time period, the vacuum level in a sealed system will exceed the threshold to close the NVLD pressure switch. Therefore, if the switch does not close under these conditions, a leak is detected. If the switch closes, the system is considered to be leak-free.

2.2.4 EVAP System, Checking for Leaks

The following procedure is used to diagnose EVAP System leaks.

Special tools and workshop equipment required

- ♦ Smoke tester.
- ♦ EVAP and Fuel Supply System Vacuum hose and line routing diagram.

Leak checking

– Using a Smoke tester, check the Evaporative Emission (EVAP) canister system for leaks.

– Always follow the manufacturers directions for the proper installation and operation of the smoke tester being used.

If a leak is detected:

– Check the fuel filler cap seal for damage and for proper installation. Replace if necessary.

– Check all hose connections of the fuel supply system and replace or repair any leaking lines.

– Check all hose connections of the EVAP system and replace or repair any leaking lines.

– Check that the seal under the locking flange is properly tightened on the fuel tank.

– Secure all hose connections using appropriate fittings for the model type.

– Replace seals and gaskets when performing repair work.

– Repair or replace any damaged component.

If no leaks are found in the EVAP system:

– Erase the DTC memory if a DTC was set. Refer to ⇒ “3.3.4 Diagnostic Mode 04 – Erase DTC Memory ”, page 24 .

– Perform a road test to verify repair.

If a DTC was set and does not return:

Diagnosis complete. Generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 17 .

If the same DTC does return and no leaks are found in the EVAP system:

– Check for any related TSB's.

– Perform the diagnostic test procedure for the suspected component.

2.3 Electronic Throttle Control (ETC) System

The electronic throttle control (ETC) system consists of the accelerator-pedal module, the engine control module (ECM), and the electronic throttle body. The electronic throttle body mainly consists of the throttle valve, the electric throttle-valve drive element, and the throttle-valve position sensor (TPS). The drive element is a DC servomotor, which acts on the throttle-valve shaft via a gear unit. The throttle-valve position sensor is a redundant sensor system that detects the position of the throttle valve. The sensors have opposite resistance curves so that the ECM can always cross check the signals to ensure the correct position of the throttle valve is always known.

The driver command is detected by a redundant sensor system in the accelerator-pedal module, and the signal is sent to the engine control module. The engine control module then determines the required throttle-valve position by performing calculations from data measured by sensors such as accelerator pedal position sensor, engine speed sensor and vehicle speed sensor. The actual throttle opening can be more or less in proportion to accelerator pedal position given different engine operating points.

2.4 Electronic Power Control (EPC) Warning Lamp

When the ignition is switched on, the engine control module (ECM) checks the electronic throttle control system for static system integrity (e.g. circuit integrity, communications, etc); the electronic power control (EPC) warning light is turned on via the Instrument Cluster during this process. Shortly after engine start, the EPC warning light is turned off if no malfunction in the electronic throttle control system is detected. In the event of a malfunction while the engine is running, the ECM will activate the EPC warning light via the Instrument Cluster and at the same time, a Diagnostic Trouble Code (DTC) is stored in the ECM memory.

2.5 Engine Control Module (ECM)

The Engine Control Module (ECM) is a generic term for any embedded system that controls one or more of the electrical systems or subsystems in a vehicle. It controls a series of actuators on an internal combustion engine to ensure that driver commands (e.g. to accelerate) are translated into appropriate engine performance. It reads values from a multitude of sensors, interprets the data, and adjusts the engine actuators accordingly. The ECM also interacts with the transmission control module (TCM), ABS/traction/stability control module and other vehicle function related control systems.

ECM controlled systems and functions (performance and emission related) will be introduced in the following chapters. These include the OBD system, controller area network (CAN), throttle control module, fuel supply, ignition, variable valve timing, exhaust-gas recirculation, secondary air injection, exhaust system, and EVAP system.

2.6 Malfunction Indicator Lamp (MIL)

When the ignition is switched on, the Engine Control Module (ECM) performs checks on static system integrity (e.g. circuit integrity, communications, etc). The Malfunction Indicator Lamp (MIL) is switched on during this process via the Instrument Cluster. After engine starts, the ECM examines engine operation for potential malfunction(s) or failure(s) that can lead to increased emission values. If no malfunction is detected, the ECM switches off the MIL via the Instrument Cluster.

In the event of a malfunction during the operation of the engine, the ECM will activate the MIL via the instrument cluster and at the same time, a Diagnostic Trouble Code (DTC) is stored in the ECM memory. In OBD systems, the MIL can have up to three stages: steady, flashing and Stop Vehicle. A steady MIL indicates a minor fault (e.g. a failing oxygen sensor) whereas a flashing MIL indicates a more severe malfunction that could result in damage of engine or exhaust system components (e.g. the catalytic converter) if left uncorrected for an extended period. This would also indicate a severe fault. The three stages are 1. ON, then OFF; 2. ON steady; 3. flashing constantly. The 3rd stage indicates damage may occur and driver must stop.

2.7 Controller Area Network (CAN)

Overview

The Controller Area Network (CAN) bus is a message-based protocol that allows control units and devices to communicate with each other using a shared network. With this system, control units of the various electronic systems are no longer interconnected by multiple separate cables. This does away with a large number of electrical connections and results in a reduced likelihood of failure of the device network.

Broadcast Communication

Each of the devices on the network has a CAN circuit and is therefore is considered “intelligent”. All devices on the network see all transmitted messages. Each device can determine if a message is relevant or if it should be filtered out. This structure allows modifications to CAN networks with minimal impact. Additional non-transmitting nodes can be added without modification to the network.

Priority

Every message has an assigned priority. If two nodes try to send messages simultaneously, the one with the higher priority gets transmitted and the one with the lower priority gets postponed. This arbitration does not affect other messages and results in non-interrupted transmission of the highest priority message

2.8 Fuel Supply

Overview

The fuel supply system delivers fuel to an internal combustion engine. With carburetors being replaced by fuel injections systems in the late 1980s and 1990s, the most common types of fuel supply system currently in use are throttle body injection (single-point injection), multiport injection (MPI) and direct injection (DI).

Fuel injectors atomize fuel because high pressure is forcing the fuel through a small nozzle in the injector into the intake air stream or the combustion chamber. This process is often controlled by the ECM and is dependent on data received from other sources (e.g. mass air flow sensor, throttle position sensor, etc.) to determine the precise amount of fuel needed for any given operating condition. The primary advantages of fuel injection over carburetor are improved fuel economy, increased power output and reduced emissions. The following sections will discuss each fuel injection concept in detail.

Throttle Body Injection

Throttle body injection uses a single electrically controlled injector at the throttle body. The fuel is drawn by an electric fuel pump out of the fuel tank and flows through a paper filter into the fuel injector. Since injection happens at the same location as the carburetor, very little engine redesign (intake manifold, fuel line routing, etc.) is necessary. The cost saving of throttle body injection compared to other fuel injection methods encouraged vast adoption in the late 1980s and early 1990s.

Throttle body injection system also inherits many disadvantages of the carburetor. One of them being the inability to precisely control the amount of fuel supplied into each cylinder, and is unable to precisely control combustion and emissions. It also restricts the design of intake manifold as any sharp bends in the intake path will cause atomized fuel to accumulate on the outer wall of the intake path. Supplying moderate engine heat to the intake manifold is also necessary to ensure that the fuel stay vaporized. This results in a relatively high intake air temperature and compromises performance.

Multiport Injection (MPI)

Multiport injection (MPI) consists of an injector for each cylinder just upstream of the intake valve. The fuel pump delivers the fuel into a high-pressure line where it flows to the fuel rail and injectors. When activated by the ECM, each injector sprays fuel at the intake port of its corresponding cylinder – this allows individual cylinders to receive the right amount of fuel in a more precisely timed manner. Sequential fuel injection mode can be applied to activate each injector individually to improve engine

response. Lowered fuel consumption and emissions are also achieved.

Sequential multiport injection is still the most common fuel injection system found on most economy cars thanks to its high efficiency, control simplicity and low manufacturing cost (compared to direct injection). However, to further improve drivability (performance) while reducing emissions and fuel consumption, direct injection becomes a superior alternative.

Direct Injection

Injectors in directly injected (DI) engines are mounted on the cylinder head and fuel is injected directly into the engine's combustion chamber. In order to overcome the pressure in the combustion chamber during compression and power stroke, injectors often operate at a primary pressure as high as 3000 psi. At such extreme pressure level, no single fuel pump can supply the required pressure directly from the fuel tank to the injectors. Instead, a low-pressure and a high-pressure system are employed. The low-pressure system principally utilizes the same fuel systems and components for multiport injected engines. The high-pressure system consists of a high-pressure fuel pump driven directly by the camshaft, a fuel rail (high-pressure accumulator), a high-pressure sensor and, depending on the system, a pressure-control valve or a pressure limiter. The injectors are operated by the ECM to send a precise amount of fuel from the high-pressure rail directly into the combustion chamber.

The distinctive difference between direct injection and other injection methods is that direct injection offers the flexibility regarding when in the combustion cycle the fuel is added and how. MPI systems can only add fuel during induction; A DI system can add fuel whenever it needs to. For example, fuel can be added during induction to create a homogeneous charge then added again after ignition to enhance power delivery under full load conditions.

VW/Audi Fuel Stratified Injection (FSI)

The goal of a stratified-charge operation is to form an ignitable mixture near the spark plug at the instant of ignition. This means that, instead of supplying the corresponding stoichiometric fuel quantity to the amount of air in the combustion chamber, the fuel interacts only with a portion of the air before it is conveyed to the spark plug. The rest of the fresh air surrounds the stratified charge allowing an ultra-lean condition with air-fuel ratio exceeding 50:1 in some instances. As less fuel is used to "burn" more air, stratified injection helps to further reduce fuel consumption when the engine is operating in low-load conditions (e.g. highway cruising). This is created by designing the combustion chamber so that a "swirling" effect of the air-fuel charge is caused.

2.9 Ignition and Timing

Ignition

A spark ignition (SI) engine requires a spark to initiate combustion in the combustion chamber. Voltage is supplied to the spark plug where the electricity will arc across a gap at a voltage as high as 100 kilovolts. The ECM determines the precise moment to fire each spark plug using ignition logic which is preprogrammed into the ECM as a function of engine speed and load. An optimally calibrated ignition system ensures consistent and reliable ignition under all conditions. Knock or misfire as a result of incorrect ignition can lead to destruction of engine components or damage of the catalytic converter.

Timing

Shifts in the moment of ignition (ignition timing) can result in increased emissions, decreased performance and fuel economy. Whereas more spark advance improves power and fuel economy, it also raises HC and NOx emissions. Excessive spark advance can cause engine knock which is potentially destructive to engines. If the ECM detects knock from a signal sent by a knock sensor, it will delay (retard) the timing of the spark. Excessive spark retard lowers power output and produces high exhaust temperatures, which can also harm the engine. Carefully designed ignition logic provides optimum timing that best balances performance, fuel economy and emissions.

2.10 Variable Valve Timing

Engines equipped with variable valve timing provide the option of adjusting the phase of the camshaft with respect to the crankshaft. This allows the ECM to control the time at which the valves open or close, and therefore better assists engine “breathing” at various engine speeds. When engine speed increases, the duration of intake and exhaust stroke shortens so that less fresh air can be drawn into the combustion chamber and less exhaust gas can escape. In such a scenario, the ECM opens the intake valve before the exhaust gas has completely left the combustion chamber, and their considerable velocity assists in drawing in the fresh charge – this is referred to as “valve overlap”.

In addition to valve timing, some engines also employ variable valve lift that switches to a more aggressive camshaft-lobe profile as engine speed increases. A more aggressive camshaft-lobe profile actuates valves more rapidly and lifts valves to a greater magnitude in comparison to a normal camshaft-lobe profile. This improves intake and exhaust flow rate, allowing engines to raise maximum operating speed and power output.

2.11 Exhaust-Gas Recirculation (EGR) System

Exhaust-Gas Recirculation (EGR) can be utilized to control the cylinder charge and therefore the combustion process. The exhaust gas that is recirculated to the intake manifold increases the proportion of inert gas in the fresh gas filling; this results in a reduction in the peak combustion temperature and, in turn, a drop in temperature-dependent NOx emission.

Exhaust-gas recirculation is made possible by a connection between the exhaust pipe and the intake manifold. Due to the pressure differential, the intake manifold can draw in exhaust gas via this connection. Together with the exhaust-gas recirculation valve, the ECM adjusts the opening cross-section and therefore controls the partial flow tapped from the main exhaust flow. A malfunction in exhaust-gas recirculation system can result in performance loss and increased emissions. In such a scenario, the Malfunction Indicator Lamp (MIL) lights up and a Diagnostic Trouble Code (DTC) is stored in the ECM memory.

2.12 Secondary Air Injection

Additionally injecting air into the exhaust pipe triggers an exothermic (release of heat) reaction. This leads to the combustion of HC and CO components that prevail mainly during the warm up phase. This oxidation process releases additional heat. Consequently, the exhaust gas becomes hotter, causing the catalytic converter to heat up at a faster rate. For spark-ignition engines, secondary-air injection is an effective means of reducing HC and CO emissions after starting the engine and to rapidly heat up the catalytic converter. This ensures that the conversion of NOx emissions commences earlier.

An electronically controlled valve operates the secondary-air valve (a one-way check valve). The ECM actuates the pump and the control valve, ensuring that secondary air can be injected at a defined point in time. The secondary air must also be injected as close to the outlet valve as possible in order to exploit the high temperatures to utilize the exothermic (release of heat) reaction effectively.

2.13 Exhaust Systems

Overview

There are three important functions of the exhaust system: to reduce the pollutants in exhaust gas, muffle engine combustion noise and to discharge exhaust gas at a convenient location on the vehicle (often underneath the rear bumper). A passenger-car exhaust system consists of the following; exhaust manifold, exhaust treatment components, sound absorption components and the system of pipes connecting these components.

Exhaust Manifold

The manifold is an important component in the exhaust system. It routes the exhaust gas out of the cylinder outlet ports into the subsequent exhaust system. The geometry of the manifold (i.e. length and cross-section of the individual pipes) has an impact on the performance characteristics, the acoustic behavior of the exhaust system, and the exhaust temperature. In some cases, the manifold is insulated with an air gap to quickly reach high exhaust temperature and to shorten the time taken by the catalytic converter to reach its operating temperature.

Emission Control

The primary emission control component is the catalytic converter, which breaks down the gaseous pollutants in the exhaust gas (CO, HC and NOx). Catalytic converters are installed as close as possible to the engine so that they can quickly reach their operating temperature and therefore be effective in urban driving. It also bears a sound-absorbing function, especially to the higher frequency portion of the engine combustion noise.

Sound Absorption

Mufflers dampen or absorb the noise produced by engine combustion. In principle, they can be installed at any position in the exhaust system. However, they are mostly located in the middle and rear sections of the exhaust system. Depending on the number of cylinders and engine output, generally 1 to 3 mufflers are used in an exhaust system. In V-engines, the left and right cylinder banks are often run separately, each being fitted with its own catalytic converters and mufflers. Although the aim of mufflers is to reduce noise in compliance with legislations, they can also help to create the sound specific to the type of vehicle.

2.14 SCR NOx Catalyst System

In order to convert harmful exhaust gas components (nitrogen oxides) to environmentally compliant components (nitrogen and water) by means of an SCR catalyst, a dosing valve injects the required amount of reductant into the exhaust system upstream of the SCR catalyst according to the actual demand. The SCR system is controlled and monitored by the SCR control module, which communicates with the ECM via CAN Bus. The SCR control module sends its diagnostic information to the ECM by means of CAN messages. The faults are stored in the fault memory of the ECM. Due to the additional SCR catalyst located downstream of the oxidation catalyst and the diesel particulate filter, nitrogen oxide emissions can be nearly eliminated. A urea solution is used as a reducing agent (the reducing agent is also referred to as Diesel Exhaust Fluid), which is injected into

the exhaust system in small quantities. The amount of injected reductant depends on the temperature upstream of the SCR catalyst, the exhaust gas flow rate, and the raw NOx emissions. The target of the dosing strategy is to provide the SCR catalyst with a sufficient amount of reductant for all driving conditions.

- The SCR system consists of multiple components to function properly. These components are explained below.
- ⇒ “2.14.1 Reducing Agent Quality Sensor G849 ”, page 14
- ⇒ “2.14.2 Reducing Agent Injector N474 ”, page 14
- ⇒ “2.14.3 Reducing Agent Metering System Delivery Unit GX19 ”, page 14
- ⇒ “2.14.4 Reducing Agent Metering System Pressure Sensor G686 ”, page 15
- ⇒ “2.14.5 Reducing Agent Heater Control Module J891 ”, page 15

2.14.1 Reducing Agent Quality Sensor - G849-

The expected quality signal is divided by the quality sensor signal. The diagnostic compares this ratio to threshold limits.

2.14.2 Reducing Agent Injector - N474-

The injection of the reductant works similarly to the injection of fuel. The SCR dosing valve injects the reductant into the exhaust gas flow upstream of the SCR catalyst. The amount of reductant that is injected is determined by the opening time of the SCR dosing valve. This opening time depends on the temperature of the exhaust gas stream upstream of the SCR catalyst, the exhaust gas flow rate and the engine's NOx emissions.

2.14.3 Reducing Agent Metering System Delivery Unit - GX19-

The delivery system, filter, pressure pump, return flow pump, damper, level and temperature sensor is an integrated module which is in the bottom of the DEF tank. The output is a multiplexed PWM signal which includes following information: DEF level and DEF temperature.

- Reducing Agent Pump - V437-
- The three-phase AC motor of the SCR dosing pump is driven by a pulse-width modulated three-phase current. The monitoring of the supply lines works in different ways, depending on whether the SCR dosing pump is turned on or off. If the SCR dosing pump is running, the current is monitored, and if the current exceeds a defined threshold value, the voltage will also be monitored. If the SCR dosing pump is off, only the voltage is monitored, which is set via the corresponding driver power stages. One phase current is used to calculate the total current while the pump is running. The monitoring of the total current and the voltage at the output terminals of the power stage for the SCR pump takes place in the SCR control module, which transmits the corresponding fault messages to the ECM, where the fault is stored in the fault memory.
- Reducing Agent Return Flow Pump - V561-
- To avoid crystallization of urea after long vehicle parking and freezing of urea under very cold conditions the backflow pump is used to empty the urea lines after each engine stop during keep alive time.

- Reducing Agent Reservoir Sensor - G697-
- To monitor the fluid level in the reductant tank, a fluid level sensor is used, which gathers information on the fluid level with the help of a Reed switch. Each voltage value transmitted by the fluid level sensor corresponds to one defined fluid level. Some SCR systems will receive an ultrasonic level sensor, which is able to display continuously the tank level over the whole range from full to empty tank warning level. Therefore refilling detection is always possible if a minimum of about 1 gallon is refilled. This sensor sends an ultrasonic impulse and receives the echo which is reflected at the DEF surface. The time between sending and receiving the impulse correlates with the DEF level. The sensor sends a multiplex PWM-signal (tank level and temperature) to the ECU. This signal contains status and fault information about the level signal (frequency, duty cycle). The signal is evaluated by the sensor driver. The driver information is used by several monitoring functions.
- Reducing Agent Temperature Sensor - G685-
- In order to check the temperature value provided by the SCR tank temperature sensor, a comparison with the ambient air temperature is carried out. If this comparison raises doubt about the correctness of the reductant temperature value and the ambient air temperature is less than a defined threshold value, the SCR tank heater is commanded on and at the same time the increase of the reductant temperature value is monitored. This is to make sure that the comparison of the SCR tank temperature and the ambient air temperature does not produce a wrong result due to a potentially frozen reductant.

2.14.4 Reducing Agent Metering System Pressure Sensor - G686-

The monitor checks if the pressure values measured in the SCR line before the pressure buildup phase are within the physically possible range. The pressure sensor measures the existing pressure in the SCR line and transmits the values to the SCR control module which then transmits them to the ECM where the pressure values are monitored.

2.14.5 Reducing Agent Heater Control Module - J891-

- Reducing Agent Tank Heater (Heating Circuit 1) - Z102-
- Reducing Agent Pump Heater (Heating Circuit 2) - Z103-
- Reducing Agent Line Heater (Heating Circuit 2) - Z104-

The SCR system contains a heater for the tank and the dosing module, including the supply line, since the reductant freezes at temperatures below 11 degrees below zero Celsius (12 degrees Fahrenheit). The electric resistance heater thaws the reductant so that it is ready for dosing. The SCR dosing line heater circuit has a high-side driver and a low-side driver, the current of which can be monitored separately. The advantage of this is that, when a short circuit is detected in one, the other driver can be switched off to ensure component protection. The SCR heater additionally has pull-up and pull-down resistors, which are used to monitor the lines when the heater is not active. For this purpose, a transistor is used to switch defined voltage levels via high Ohmic resistors (pull-up, pull-down) and the voltage of the corresponding lines is monitored. The circuit monitoring of the SCR dosing line heater takes place in the SCR control module, which transmits the fault messages to the ECM, where the corresponding fault is stored in the fault memory.

3 Diagnosis and Testing

3.1 Preliminary Check

Note

- *Before performing any pin point test or component diagnosis, a Preliminary Check must be performed.*
- *Check for Technical Bulletins that may supersede any information included in the repair manual or GST Manual.*

- For Electrical Testing: Refer to ⇒ page 16 .
- For Fuel System Mechanical Testing: Refer to ⇒ page 17 .
- For Oxygen Sensor Preliminary Tests: Refer to ⇒ page 17 .

Electrical Testing

Step	Procedure	Result / Action to Take
1	• CONNECT: Scan Tool. • IGNITION: ON. • CHECK: For stored or related DTCs. – Were any other DTCs stored?	– YES: ♦ GO TO: Step 2 ⇒ page 16 . – NO: ♦ GO TO: Step 3 ⇒ page 16 .
2	• Repair these DTCs first before performing any of the following steps.	♦ GO TO: Proper Diagnostic procedure per the stored DTC. Refer to ⇒ “3.4 Engine DTC Tables ”, page 36 .
3	• Using the Scan Tool, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 – Erase DTC Memory ”, page 24 . • Perform a road test to attempt to duplicate the customers complaint. – Does DTC return?	– YES: ♦ GO TO: Step 4 ⇒ page 16 . – NO: ♦ GO TO: Step 5 ⇒ page 16 .
4	• Perform the diagnostic procedure for that DTC.	♦ GO TO: Proper Diagnostic procedure per the stored DTC. Refer to ⇒ “3.4 Engine DTC Tables ”, page 36 .
5	• FAULT: Intermittent or a sporadic condition. • CHECK: Suspected components. • PERFORM: Visual Inspection of wiring and components. • CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. • REPAIR: Faulty wiring or connector.	♦ Perform a road test to verify the repair. ♦ Generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 17 .

Fuel System Mechanical Testing

Check the following items for possible mechanical delivery deficiency:

- Fuel level in tank is too low.
- Fuel lines pinched.
- Fuel filter plugged.
- Fuel pump delivery unit internal leak.
- Clogged injectors.
- Poor fuel quantity delivery. Refer to appropriate repair manual.

Oxygen Sensor Preliminary Tests

Check for the following conditions which can cause Oxygen Sensor Faults to set without requiring Oxygen Sensor replacement:

Common issues for lean faults:

- ♦ Vacuum leaks - check for failed or loose vacuum lines, leaking intake gaskets, or any other source of un-metered air leaks (leaks after the Mass Air Flow Sensor).
- ♦ Restricted fuel filter or bent/pinched fuel system lines.
- ♦ Incorrect input from other sensors, such as the Mass Air Flow Sensor, which may not always set a fault.
- ♦ Engine misfire.
- ♦ Exhaust leaks.
- ♦ Camshaft timing.

Common issues for rich faults:

- ♦ Leaking or faulty fuel injector.
- ♦ Fuel injector driver shorted in ECM, or wiring short for injectors (short to ground).
- ♦ Leaking or faulty fuel pressure regulator or restricted return line.
- ♦ Faulty fuel pump or fuel pump driver module.
- ♦ Incorrect input from other sensors, such as the Mass Air Flow Sensor, which may not always set a fault.
- ♦ Aftermarket components or performance chips.
- ♦ Camshaft timing.

3.2 Readiness Code

Readiness code description

Diagnostics are performed at regular intervals during normal vehicle operation. After repairing an emissions related system, a readiness code is generated by road testing the vehicle.

If a malfunction is recognized during the drive cycle, it will be stored in the DTC memory.

The OBD drive cycle operation will be monitored with a hand held diagnostic tool. Consult the manufacturer's instruction manual for correct tool operation.

The readiness code is erased every time the DTC memory is erased or any time the battery is disconnected. If the DTC

memory has been erased or the battery is disconnected, a new readiness code must be generated.

Only erase the DTC memory if a DTC has been stored.

General recommendations

Most monitors will complete easier and quicker using a “steady-foot” and “smooth” acceleration during the drive cycle operation, cruise, and acceleration modes.

Operating conditions

For the EVAP monitor test, the coolant temperature and the ambient air temperature must be between 10° C and 35° C with a difference between them no greater than 4° C. The ambient air temperature must not change more than 4° C during the drive cycle procedure (e.g. when driving out of a heated workshop in the winter).

Test requirements

- Erase the DTC memory.
- Coolant temperature must be between 80° C and 110° C.
- The intake air temperature must be between 10° C and 35° C.
- Battery voltage must be a minimum of 12.5 volts.
- Fuel tank level 1/4 to 3/4 full.

Drive Cycle Procedure

– Connect the scan tool.

– Switch the ignition on and start the vehicle.

– Idle the vehicle for 2-3 minutes. This executes the O2 heater, misfire, secondary air injection, fuel trim, and purge system monitors.

– Drive the vehicle at 45-55 mph for a continuous 7 minute period - avoid stopping. This executes the evaporative, O2 sensor, fuel trim, and misfire monitors.

– Accelerate the vehicle to an engine speed of 5000 RPM; lift off the throttle until the engine speed is around 1200 RPM. This executes the fuel cut off.

– Accelerate the vehicle smoothly to 60-65 mph, cruise constantly for 5 min, this executes the catalyst; O2 sensor, misfire, fuel trim, and purge system monitors.

– Decelerate and idle the vehicle again for 3 minutes. This executes the misfire, secondary sir injection, fuel trim, and purge system monitors.

– Check the status of the readiness code.

Note

Depending on the scan tool used. The readiness code status may be displayed as complete, passed or OK.

– If any engine monitor fails the drive cycle test. Repeat the drive cycle test until all engine monitors have successfully run through and passed.

Note

When repeating the drive cycle operation for a failed evaporative or thermostat monitor, allow the engine to cool until the coolant temperature and the ambient air temperature are be between 10° C and 35° C with a difference no greater than 4° C and repeat the drive cycle operation.

If the drive cycle operation fails again.

– Check the DTC memory for stored DTCs.

Repair the vehicle if necessary.

– Repeat the drive cycle operation until all engine monitors have successfully run through and passed.

– Remove the scan tool and switch the ignition off.

3.3 Diagnostic Modes 01 – 09

The information provided in Modes 01 through 09 displays the various levels of emission related data that may be monitored, as well as the ability to retrieve and read stored DTC trouble codes, erase stored DTC trouble codes, generate readiness codes, and select the various PIDs and Test-IDs used within the modes to monitor the engine, and emission related component parameters.

Note

Depending on scan tool and protocol used, the information in diagnostic mode 01 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).

- ⇒ “3.3.1 Diagnostic Mode 01 – Read Current System Data ”, page 20
- ⇒ “3.3.2 Diagnostic Mode 02 – Read Operating Conditions ”, page 21
- ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23
- ⇒ “3.3.4 Diagnostic Mode 04 – Erase DTC Memory ”, page 24
- ⇒ “3.3.5 Diagnostic Mode 06 – Read Test Results for Specific Diagnostic Functions ”, page 25
- ⇒ “3.3.6 Diagnostic Mode 07 – Read Faults Detected During the Current or Last Driving Cycle ”, page 33
- ⇒ “3.3.7 Diagnostic Mode 08 – Request Control of On-Board System, Test or Component ”, page 34
- ⇒ “3.3.8 Diagnostic Mode 09 – Read Vehicle Information ”, page 34
- ⇒ “3.3.9 Diagnostic Mode 0A – Check Permanent DTC Memory”, page 35

3.3.1 Diagnostic Mode 01 – Read Current System Data

Note

Depending on scan tool and protocol used, the information in diagnostic mode 01 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), or On-Board Diagnostic Monitor Identifier (OBDMID).

Diagnostic Mode 01 makes it possible to access current emissions-related measured values and diagnostic data. The original measured values (no replacement values), input and output data and system status information are displayed using Diagnostic Mode 1.

Test requirement

- Coolant temperature at least 80° C.

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 1: Obtain data”.

– From the following table, select the desired “PID” that is to be monitored, e.g. “PID $05 Coolant Temperature”.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
$01:	Monitoring Status Since Erasing DTC Memory
$04:	Calculated Load Value
$05:	Coolant Temperature
$0B:	Manifold Absolute Pressure
$0C:	Engine RPM
$0D:	Vehicle Speed
$0F:	Intake Air Temperature
$10:	Air Flow Rate
$13:	Location Of Oxygen Sensor
$1C:	OBD Status Of Vehicle
$1F:	Time Since Engine Start
$21:	Distance Driven With MIL On
$23:	Fuel Pressure
$24:	Bank 1 Sensor 1 (Wide Range O2S)
$25:	Bank 1 Sensor 2 (Wide Range O2S)
$2C:	Commanded EGR Position
$2D:	EGR Error Between Actual And Commanded
$2F:	Fuel Level (If Used For Diagnostics)
$30:	Number Of Warm Up Cycles Since Fault Memory Cleared
$31:	Distance Driven After Fault Memory Cleared
$33:	Barometric Pressure
$3C:	Catalyst Temperature Bank 1 Sensor 1
$3D:	Catalyst Temperature Bank 2 Sensor 1

PID	Component or System
$3E:	Catalyst Temperature Bank 1 Sensor 2
$3F:	Catalyst Temperature Bank 2 Sensor 2
$41:	Monitor Status (Diesel)
$42:	Engine Control Module System Voltage
$43:	Absolute Load
$45:	Relative Throttle Position
$46:	Ambient Temperature
$49:	Absolute Pedal Position
$4A:	Redundant Absolute Pedal Position
$4C:	Commanded Throttle Motor Position
$4D:	Engine Run Time While MIL Is Activated
$4F:	External Test Equipment Configuration Information #1
$5D:	Fuel Injection Timing
$5E:	Engine Fuel Rate
$61:	Driver's Demand Engine - Percent Torque
$62:	Actual Engine Percent Torque
$63:	Engine Reference Torque
$65:	Auxiliary Inputs/Outputs
$67:	Engine Coolant Temperature
$69:	Commanded EGR And EGR Error
$6B:	Exhaust Gas Recirculation Temperature
$6D:	Fuel Pressure Control System
$70:	Boost Pressure Control
$71:	Variable Geometry Turbo (VGT) Control
$73:	Exhaust Pressure
$77:	Charge Air Cooler Temperature
$78:	Exhaust Gas Temperature (EGT) Bank 1
$7A:	Diesel Particulate Filter (DPF) Bank 1
$7F:	Engine Run Time
$81:	Total Engine Run Time For AECD
$8B:	Diesel After Treatment Status

– Switch the ignition off.

3.3.2 Diagnostic Mode 02 – Read Operating Conditions

When an emissions-related fault (pending DTC, visible in mode 07) is first detected, operating conditions are stored. Mode 02 makes it possible to access this freeze frame data as soon as this fault is shown in mode 03. Each control module only shows freeze frame data for one fault via mode 02. Therefore, there are two priority levels. If there is a malfunction with higher priority, the freeze frame data is overwritten.

– Fault with higher priority: Misfire malfunction or fuel trim malfunction.

– Fault with normal priority: All other emissions-related faults.

Note

Depending on scan tool and protocol used, the information in diagnostic mode 02 may be referred to by different names such as Test-ID, Hex-ID, Component-ID, or On-Board Diagnostic Monitor Identifier (OBDMID).

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

Note

If the engine does not start, crank the engine using starter for at least 5 seconds, do not switch the ignition off afterward.

– Select “Diagnostic Mode 2: Obtain operating conditions”.

– From the following table, select the desired “PID”, e.g. “PID $05 Coolant Temperature” that is to be monitored.

The current values of the component or system that is being monitored will be displayed on the scan tool screen.

PID	Component or System
$02:	DTC Which Triggered Freeze Frame Data
$04:	Calculated Load Value
$05:	Coolant Temperature
$0B:	Manifold Absolute Pressure
$0C:	Engine RPM
$0D:	Vehicle Speed
$0E:	Ignition Timing Advance For # 1 Cylinder
$0F:	Intake Air Temperature
$10:	Air Flow Rate
$11:	Absolute Throttle Position
$1F:	Time Since Engine Start
$23:	Fuel Pressure
$2C:	Commanded EGR Position
$2D:	EGR Error Between Actual And Commanded
$33:	Barometric Pressure
$42:	Engine Control Module System Voltage
$46:	Ambient Temperature
$49:	Absolute Pedal Position
$4A:	Redundant Absolute Pedal Position
$4C:	Commanded Throttle Motor Position
$51:	Type Of Fuel Currently Being Used
$5D:	Fuel Injection Timing
$5E:	Engine Fuel Rate
$61:	Driver Demand - Engine Torque Percent
$62:	Actual Engine Torque Percent
$63:	Engine Reference Torque
$67:	Engine Coolant Temperature

PID	Component or System
$69:	Commanded EGR And EGR Error
$6B:	Exhaust Gas Recirculation Temperature
$6D:	Fuel Pressure Control System
$70:	Boost Pressure Control
$71:	Variable Geometry Turbo (VGT) Control
$73:	Exhaust Pressure Sensor Bank 1
$77:	Charge Air Cooler Temperature
$78:	Exhaust Gas Temperature (EGT) Bank 1
$7A:	Diesel Particulate Filter (DPF) Bank 1
$7F:	Engine Run Time
$8B:	Diesel After Treatment Status

– Switch the ignition off.

3.3.3 Diagnostic Mode 03 – Read DTC Memory

Diagnostic Mode 03 makes it possible to read emissions-related faults (confirmed DTCs: faults which have activated the MIL) in the ECM and in the TCM.

When the ECM recognizes an emission related fault it turns on the malfunction indicator lamp. If an electronic throttle malfunction is recognized, the ECM turns on the electronic power control warning lamp. Both are located in the instrument cluster.

The DTCs are sorted by SAE code with the DTC tables consisting of a 5 digit alpha numeric value.

Note

Depending on scan tool and protocol used, diagnostic mode 03 and the information provided may be referred to by a different name.

The following tables provide a breakdown and explanation of the DTC code.

P-Codes

Component group					
P	x	x	x	x	DTC for the drivetrain
Norm-Code					
P	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts
P	1	x	x	x	Additional emission relevant DTCs provided by the manufacturer
P	2	x	x	x	DTCs defined by SAE with specified texts, from MY 2000
P	3	x	x	x	Additional emission relevant DTCs provided by the manufacturer from MY 2000

Component group					
Repair group					
P	x	0	x	x	Fuel and air mixture and additional emission regulations

P	x	1	x	x	Fuel and air ratios
P	x	2	x	x	Fuel and air ratios
P	x	3	x	x	Ignition system
P	x	4	x	x	Additional exhaust system
P	x	5	x	x	Speed and idle control
P	x	6	x	x	Control module and output signals
P	x	7	x	x	Transmission
P	x	8	x	x	Transmission
P	x	9	x	x	Control modules, input and output signals

U-Codes

Component group					
U	x	x	x	x	DTC for network (CAN bus)
Norm-Code					
U	0	x	x	x	Trouble codes defined by SAE with specified malfunction texts

Procedure

– Connect the scan tool.

– Switch the ignition to the ON position.

– Select Diagnostic Mode 03: Interrogating fault memory.

– The stored DTC or DTCs will be displayed on the scan tool screen.

The following table is an example of the DTC information that may be displayed on the scan tool screen:

Indication example	Explanation
P0444	SAE Diagnostic Trouble Code
Evaporative emission canister purge regulator valve	Malfunctioning wiring path or malfunctioning component
Circuit open	Malfunction type as next

– Refer to the DTC tables for the diagnostic repair procedures.

– Switch the ignition off.

3.3.4 Diagnostic Mode 04 – Erase DTC Memory

Diagnostic Mode 04 makes it possible to erase the DTC memory and to reset all emissions-related diagnostic data. In that way, all faults in the DTC memory in the ECM and TCM are erased. The adaptation values may also be reset.

Emissions-related diagnostic data includes (as applicable):

- - MIL Status
- - Number of DTCs
- - Readiness bits
- - Confirmed DTCs

- ♦ - Pending DTCs
- ♦ - DTC that belongs to freeze frame
- ♦ - Freeze frame data
- ♦ - Test results of specific diagnostic functions
- ♦ - Distance driven with “MIL ON”
- ♦ - Number of warm-up cycles after erasing the DTC memory
- ♦ - Distance driven after erasing the DTC memory
- ♦ - Misfire counter

Note

Depending on scan tool and protocol used, diagnostic mode 04 and the information provided may be referred to by a different name.

Procedure

– Connect the scan tool.

– Switch the ignition on.

– Select Diagnostic Mode 03: Interrogating fault memory.

– Then select Mode 4: Reset/delete diagnostic data.

The scan tool will display: Diagnostic data are being erased.

– Switch the ignition off.

3.3.5 Diagnostic Mode 06 – Read Test Results for Specific Diagnostic Functions

Diagnostic Mode 06 makes it possible to retrieve test results for special components and systems which are continuously or not continuously monitored. If the diagnosis of a system is complete, the diagnostic result and the corresponding thresholds are saved and displayed in mode 06. This data remains saved (even with the ignition off) until either new diagnostic results become available or the DTC memory is erased.

The min & max values for each individual test in Mode 06 represent the min & max operating values for a properly operating system. This data is provided to the individual aftermarket scan tool companies for development of their scan tool. Depending on the scan tool being used, the min & max values shown may vary, or be rounded up or down to the nearest decimal point depending on the aftermarket scan tool company's development process.

For example; GST manual documentation will show the value as 0.3499 (units) while the scan tool will display the same value as 0.35 (units).

Depending on the scan tool and protocol used, the information displayed in Diagnostic Mode 06 may be referred to by different names such as Test-ID (TID), Hex-ID, Component-ID (CID), On-Board Diagnostic Monitor Identifier (OBDMID), or contain no name at all and may be referenced by only a number.

Test requirements

- Exhaust system must be properly sealed between the catalytic converter and the cylinder heads.
- No DTCs stored in the DTC memory.

- Coolant temperature at least 80° C.

Work procedure

– Connect the scan tool.

– Start the engine and let run at idle speed.

– Select Mode 6: Check / test the results of components that are not continuously monitored.

Select the desired Test-ID.

The current minimum and maximum values will be displayed on the scan tool screen.

The following table is a numerical list of all “Test-IDs” that may be selected.

Monitor-ID	Component or System
$01: ⇒ page 26	Oxygen Sensor Monitor Bank 1 – Sensor 1
$02: ⇒ page 27	Oxygen Sensor Monitor Bank 1 – Sensor 2
$21: ⇒ page 28	Catalytic Converter Monitoring
$31: ⇒ page 28	EGR Control Loop
$81: ⇒ page 29	Zero Fuel Calibration Monitor
$85: ⇒ page 29	Boost Pressure Control Loop
$90: ⇒ page 30	NOx Absorber Efficiency
$A2: ⇒ page 30	Mis-Fire Cylinder 1 Data
$A3: ⇒ page 31	Mis-Fire Cylinder 2 Data
$A4: ⇒ page 31	Mis-Fire Cylinder 3 Data
$A5: ⇒ page 32	Mis-Fire Cylinder 4 Data
$B2: ⇒ page 32	Particulate Matter Trap Efficiency

Monitor-ID $01: Oxygen Sensor Monitor Bank 1 – Sensor 1

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 06: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $01”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$C1	P0133	HO2 Sensor Bank 1, Sensor 1 Dynamic Check Part 1.	0.0 s	6,553.5 s	Refer to DTC P0133 in the DTC summary table. ⇒ page 54
$C2	P0133	HO2 Sensor Bank 1, Sensor 1 Dynamic Check – Part 2.	0.0 s	6,553.5 s	Refer to DTC P0133 in the DTC summary table. ⇒ page 54
$C4	P2195	HO2 Sensor Bank 1, Sensor 1 Plausibility Check – Part Load.	0.0%	100.01%	Refer to DTC P2195 in the DTC summary table. ⇒ page 128
$C4	P2196	HO2 Sensor Bank 1, Sensor 1 Plausibility Check – Part Load.	0.0%	100.01%	Refer to DTC P2196 in the DTC summary table. ⇒ page 129

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$C5	P2195	HO2 Sensor Bank 1, Sensor 1 Plausibility Check – Over Run.	0.0%	100.01%	Refer to DTC P2195 in the DTC summary table. ⇒ page 128
$C5	P2196	HO2 Sensor Bank 1, Sensor 1 Plausibility Check – Over Run.	0.0%	100.01%	Refer to DTC P2196 in the DTC summary table. ⇒ page 129
$C6	P014D	HO2 Sensor Bank 1, Sensor 1 Dynamic Check With Bank 1, Sensor 2.	0.0 s	6,553.5 s	Refer to DTC P014D in the DTC summary table. ⇒ page 59
$C7	P0133	HO2 Sensor Bank 1, Sensor 1 Dynamic Check – Part 2.	0.0 s	6,553.5 s	Refer to DTC P0133 in the DTC summary table. ⇒ page 54

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 .

– Switch the ignition off.

Monitor-ID $02: Oxygen Sensor Monitor Bank 1 – Sensor 2

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 06: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $02”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$C1	P0139	HO2 Sensor Bank 1, Sensor 2 Dynamic Check Part 1.	0.0 s	6,553.5 s	Refer to DTC P0139 in the DTC summary table. ⇒ page 56
$C2	P0139	HO2 Sensor Bank 1, Sensor 2 Dynamic Check – Part 2.	0.0 s	6,553.5 s	Refer to DTC P0139 in the DTC summary table. ⇒ page 56
$C4	P2270	HO2 Sensor Bank 1, Sensor 2 Plausibility Check – Part Load.	0.0%	100.01%	Refer to DTC P2270 in the DTC summary table. ⇒ page 131
$C4	P2271	HO2 Sensor Bank 1, Sensor 2 Plausibility Check – Part Load.	0.0%	100.01%	Refer to DTC P2271 in the DTC summary table. ⇒ page 132
$C5	P2270	HO2 Sensor Bank 1, Sensor 2 Plausibility Check – Over run.	0.0%	100.01%	Refer to DTC P2270 in the DTC summary table. ⇒ page 131
$C5	P2271	HO2 Sensor Bank 1, Sensor 2 Plausibility Check – Over run.	0.0%	100.01%	Refer to DTC P2271 in the DTC summary table. ⇒ page 132
$C6	P013B	HO2 Sensor Bank 1, Sensor 2 Dynamic Check With Bank 1, Sensor 1.	0.0 s	6,553.5 s	Refer to DTC P013B in the DTC summary table. ⇒ page 57

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$C7	P0139	HO2 Sensor Bank 1, Sensor 2 Dynamic Check – Part 2.	0.0 s	6,553.5 s	Refer to DTC P0139 in the DTC summary table. ⇒ page 56

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 .

– Switch the ignition off.

Monitor-ID $21: Catalytic Converter Monitoring

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 06: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $21”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$C0	P0420	Catalytic Converter Monitoring.	0.0	19.99	Refer to DTC P0420 in the DTC summary table. ⇒ page 87

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 .

– Switch the ignition off.

Monitor-ID $31: EGR Control Loop

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 06: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $31”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$C0	P0401	EGR Control Loop.	-3,276.8 mg/stroke	3,276.7 mg/stroke	Refer to DTC P0401. in the DTC summary table. ⇒ page 84
$C0	P0402	EGR Control Loop.	-3,276.8 mg/stroke	3,276.7 mg/stroke	Refer to DTC P0402 in the DTC summary table. ⇒ page 85

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$C2	P0402	EGR High Flow.	0.0	19.99	Refer to DTC P0402 in the DTC summary table. ⇒ page 85
$CA	P2457	Low-Pressure EGR Cooler. Cooler Performance Check.	- 3,276.7° C	3,276.7° C	Refer to DTC P2457 in the DTC summary table. ⇒ page 139
$D0:	P240F	EGR Slow Response Positive.	-3,276.8 mg/stroke	3,276.7 mg/stroke	Refer to DTC P240F in the DTC summary table. ⇒ page 135
$D1:	P240F	EGR Slow Response Negative.	-3,276.8 mg/stroke	3,276.7 mg/stroke	Refer to DTC P240F in the DTC summary table. ⇒ page 135

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 .

– Switch the ignition off.

Monitor-ID $81: Zero Fuel Calibration Monitor

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 06: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $81”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$C1	P0263	Zero Fuel Calibration Monitor Cylinder 1.	0.0 µs	6,553.5 µs	Refer to DTC P0263 in the DTC summary table. ⇒ page 68
$C2	P0266	Zero Fuel Calibration Monitor Cylinder 2.	0.0 µs	6,553.5 µs	Refer to DTC P0266 in the DTC summary table. ⇒ page 69
$C3	P0269	Zero Fuel Calibration Monitor Cylinder 3.	0.0 µs	6,553.5 µs	Refer to DTC P0269 in the DTC summary table. ⇒ page 70
$C4	P0272	Zero Fuel Calibration Monitor Cylinder 4.	0.0 µs	6,553.5 µs	Refer to DTC P0272 in the DTC summary table. ⇒ page 72

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 .

– Switch the ignition off.

Monitor-ID $85: Boost Pressure Control Loop

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 06: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $85”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$C3	P00AF	Charge Air Boost Pressure Control Loop.	0.0%	100.01%	Refer to DTC P00AF in the DTC summary table. ⇒ page 45
$CA	P026A	Charge Air Cooler Under-Cooling.	0.0	19.99	Refer to DTC P026A in the DTC summary table. ⇒ page 71

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 .

– Switch the ignition off.

Monitor-ID $90: NOx Absorber Efficiency

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 06: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $90”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$C0	P2000	NOx Absorber Missing Substrate.	0.0 g	65.535 g	Refer to DTC P2000 in the DTC summary table. ⇒ page 117
$C6	P2000	NOx Absorber Storage Capacity.	0.0 g	65.535 g	Refer to DTC P2000 in the DTC summary table. ⇒ page 117

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 .

– Switch the ignition off.

Monitor-ID $A2: Mis-Fire Cylinder 1 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 06: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $A2”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$0B	P0301	Misfire Cylinder 1, Average Value Over 10 Driving Cycles.	0.0 (counts)	65,535.0 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 76
$0C	P0301	Misfire Cylinder 1, In This Driving Cycle.	0.0 (counts)	65,535.0 (counts)	Refer to DTC P0301 in the DTC summary table. ⇒ page 76

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 .

– Switch the ignition off.

Monitor-ID $A3: Mis-Fire Cylinder 2 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 06: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $A3”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$0B	P0302	Misfire Cylinder 2, Average Value Over 10 Driving Cycles.	0.0 (counts)	65,535.0 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 78
$0C	P0302	Misfire Cylinder 2, In This Driving Cycle.	0.0 (counts)	65,535.0 (counts)	Refer to DTC P0302 in the DTC summary table. ⇒ page 78

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 .

– Switch the ignition off.

Monitor-ID $A4: Mis-Fire Cylinder 3 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 06: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $A4”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$0B	P0303	Misfire Cylinder 3, Average Value Over 10 Driving Cycles.	0.0 (counts)	65,535.0 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 80
$0C	P0303	Misfire Cylinder 3, In This Driving Cycle.	0.0 (counts)	65,535.0 (counts)	Refer to DTC P0303 in the DTC summary table. ⇒ page 80

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 .

– Switch the ignition off.

Monitor-ID $A5: Mis-Fire Cylinder 4 Data

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 06: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $A5”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$0B	P0304	Misfire Cylinder 4, Average Value Over 10 Driving Cycles.	0.0 (counts)	65,535.0 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 82
$0C	P0304	Misfire Cylinder 4, In This Driving Cycle.	0.0 (counts)	65,535.0 (counts)	Refer to DTC P0304 in the DTC summary table. ⇒ page 82

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 .

– Switch the ignition off.

Monitor-ID $B2: Particulate Matter Trap Efficiency

– Connect the scan tool.

– Start the engine and run at idle.

– Select “Diagnostic Mode 06: Check / test the results of components that are not continuously monitored”.

Select “Monitor-ID $B2”.

– Select the desired “Test-ID”.

– Check specified values at idle.

Test-ID	DTC	Component or System	Min.	Max.	Additional Information
$C4	P2458	No Complete PM Regeneration.	0.0 s	65,535.0 s	Refer to DTC P2458 in the DTC summary table. ⇒ page 140
$C5	P2459	Frequency PM Regeneration.	0.0 g	655.35 g	Refer to DTC P2459 in the DTC summary table. ⇒ page 141
$D1	P2002	Particulate Matter Trap Missing Over Delta Pressure.	0.0 kPa	655.35 kPa	Refer to DTC P2002 in the DTC summary table. ⇒ page 118
$D2	P2002	Particulate Matter Trap Missing Over Temperature Gradient.	0.0 kPa	655.35 kPa	Refer to DTC P2002 in the DTC summary table. ⇒ page 118
$D5	P2002	Particulate Matter Trap Efficiency Over Delta Pressure EGR-LP Filter.	-32.768 mg/stroke	32.767 mg/stroke	Refer to DTC P2002 in the DTC summary table. ⇒ page 118

– If any of the components or systems fail to meet the specified values, refer to Diagnostic “Mode 03: Interrogating Fault Memory” to check for stored DTC's or the corresponding diagnostic repair procedure ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 .

– Switch the ignition off.

3.3.6 Diagnostic Mode 07 – Read Faults Detected During the Current or Last Driving Cycle

Mode 07 makes it possible to check emissions-related faults which appeared during the current or last driving cycle (pending DTCs).

A pending DTC is saved the first time a fault is detected (output via Mode 07).

– If the fault is detected again by the end of the following driving cycle, a confirmed DTC is entered (output via Mode 03) and the MIL is activated.

– If this malfunction is not detected again by the end of the following driving cycle, the corresponding pending code will be deleted at the end of the driving cycle.

Note

Depending on scan tool and protocol used, some of the information provided may be referred to by a different name.

Procedure

– Connect the scan tool.

– Start the engine and run at idle.

Note

If the engine does not start, crank the engine using starter for at least 5 seconds. Do not switch the ignition off afterward.

– Select Mode 7: Check test results of components that are continuously monitored.

The number of pending DTCs or 0 malfunctions detected will be displayed on the scan tool screen.

– Refer to the DTC tables for the diagnostic repair procedures.

– Switch the ignition off.

3.3.7 Diagnostic Mode 08 – Request Control of On-Board System, Test or Component

Diagnostic Mode 08 is used to control the operation of an on-board system, test or component. A Mode 8 service can be used to turn on-board system ON or OFF, or to cycle an on-board system, test or component on or off for a specific period of time. The service can also be used to request system status or to report test results.

Function test

– No Function Tests are available for this powertrain.

3.3.8 Diagnostic Mode 09 – Read Vehicle Information

Diagnostic Mode 09 makes it possible to access vehicle-specific information from the ECM and the TCM (where applicable).

Note

Depending on scan tool and protocol used, Diagnostic Mode 09 and the information provided may be referred to by a different name.

Test requirement

- No DTCs stored in the DTC memory.

Procedure

– Connect the scan tool.

– Switch the ignition on.

– Select Mode 09: Vehicle information.

– Select the desired “Test-ID”.

– The information requested will be displayed on the scan tool screen.

The following table is a numerical list of all “Test-IDs” that may be selected.

Test-ID	Diagnostic text
02:	Vehicle identification number e.g.
	♦ A different 17 digit number will be displayed for each vehicle
04:	Calibration identification e.g.
	♦ Engine Control Module
	♦ Transmission Control Module
06:	CVN (check sum) e.g.

Test-ID	Diagnostic text
	♦ EC5AE460 the check sum is different for every control module version
	♦ 000D105
0A	ECU Name
	♦ Engine Control Module

– Switch the ignition off.

3.3.9 Diagnostic Mode 0A – Check Permanent DTC Memory

Mode 0A - Check Permanent DTC Memory (Request emissions-related diagnostic trouble codes with permanent status after code clear)

Permanent Fault Codes From MY 2010 with Phase-In conforming to CCR 1968.2 (d)(2.2.5): 50% from MY 2010 / 75% from MY 2011 / 100% from MY 2012 The vehicle only participates in Phase-In if all of the OBD-relevant control modules in the vehicle meet these requirements.

Mode 0A may only be supported exclusively by OBD control modules in US vehicles. Mode 0A may not be supported in EOBD vehicles, meaning the control module may not send a response here.

Mode 0A enables the request of all OBD-relevant faults with the status “Permanent Fault Code”: - Permanent Fault Codes are Confirmed Fault Codes that are currently activating the MIL. That means faults that are still displayed in Mode 03 but no longer activate the MIL (History Fault Codes) are not Permanent Fault Codes. - Permanent Fault Codes are updated in Mode 0A at the same time as NVRAM storage immediately after switching the ignition off. A newly detected Permanent Fault Code is only visible after switching the ignition off/on in Mode 0A. - Permanent Fault Codes may only be erased in the control module after they are corrected as long as the last diagnostic result was a PASS and the MIL is no longer activated by this fault. The Permanent Fault Codes should be erased from Mode 0A at the same time the MIL switches off when the ignition is switched off/on. - Permanent Fault Codes may not be erased by clearing the DTC memory or disconnecting the power supply. Storage in NVRAM is required. - Permanent Fault Codes may only be erased after clearing the DTC memory under the following conditions: - As long as no FAIL diagnostic result was detected for a Permanent Fault Code - and at least one PASS diagnostic result was detected - and the Minimum Trip Conditions for a General Denominator (without considering high/ambient temperature) were met in this phase in any DCY after erasing the DTC memory. - The engine control module relays the message “Minimum Trip conditions met” to all other OBD control modules via CAN: CAN message OBD_01, Byte 8, Bit 4: OBD_Minimum_Trip - Permanent Fault Codes may NOT be erased if the diagnostic result is FAIL after clearing the DTC memory. A Pending Fault Code should be stored and the DTC memory line should be overwritten with new Freeze Frame data. (Exception: If the Pending Fault Code is corrected without a Confirmed Fault Code being detected, the Permanent Fault Code may also be erased under the conditions described below.) - Permanent Fault Codes should be erased in engine control modules after Update Programming. At this time, all readiness bits (Mode 01 PID $01) must be reset to “not complete” [(g)(4.4.6)(D)]. Permanent Fault Codes should not be erased in OBD control modules with Comprehensive Components (CCM) as a single

readiness bit if the identical program/data status is being programmed. If a different program/data status is being programmed, Permanent Fault Codes should be erased after Update Programming. - The procedure in Mode 01 through Mode 09 and in the service tester is NOT affected by implementation of the Permanent Fault Codes.

3.4 Engine DTC Tables

◆ ⇒ “3.4.1 Engine Control Module , 2010 – 2014 MY”, page 36

3.4.1 Engine Control Module , 2010 – 2014 MY

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P000E Fuel Volume Regulator Control Exceeded Learning Limit	HO2 Sensors Adaptive Correction Of The Lambda-Pre Control Signal	• Number of learning points at adaptation limits >= 8 of 64 [-] • Upper limit > 1.2 [-]		• 100.0 ms	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 . – Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 261 .
P0045 Turbocharger/ Supercharger Boost Control "A" Circuit/ Open	Wastegate Bypass Regulator Valve Circuit Open	• Signal voltage < 4.7 V	• ECM power stage = off	• 480.0 ms	• 2 DCY	– Check the Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ “3.6.34 Wastegate Bypass Regulator Valve N75 , Checking”, page 274 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0047 Turbocharger/ Supercharger Boost Control "A" Circuit Low	Wastegate Bypass Regulator Valve Circuit Short To Ground	• Signal voltage < 2.97 V	• ECM power stage = off	• 480.0 ms	• 2 DCY	– Check the Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ “3.6.34 Wastegate Bypass Regulator Valve N75 , Checking”, page 274 .
P0048 Turbocharger/ Supercharger Boost Control "A" Circuit High	Wastegate Bypass Regulator Valve Circuit Short To Battery Voltage	• Signal current > 3.0 A	• ECM power stage = off	• 480.0 ms	• 2 DCY	– Check the Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ “3.6.34 Wastegate Bypass Regulator Valve N75 , Checking”, page 274 .
P0071 Ambient Air Temperature Sensor Circuit "A" Range/ Performance	Ambient Air Temperature Sensor Circuit Range/ Performance	• Temperature difference to at least 3 other temperature sensors at startup > 45 K	• Engine off time > 9.0 hrs • IAT change after engine start < 5 K • ECT sensor 1 or 2 < 30° C • Decrease of coolant temperature 1 or 2 after engine start < 5 K	• 60.0 s, including 20.0 s continuous driving with velocity exceeding 25 mph • Continuous	• 2 DCY	– Check the Outside Air Temperature Sensor - G17- . Refer to ⇒ “3.6.27 Outside Air Temperature Sensor G17 , Checking”, page 259 . – Check the CAN-Bus terminal resistance. Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0072 Ambient Air Temperature Sensor Circuit "A" Low	Ambient Air Temperature Sensor Circuit Low	• Error message sent from cluster to ECU	• Communication time after T15 on > 1.0 s	• 2.0 s	• 2 DCY	– Check the Outside Air Temperature Sensor - G17- . Refer to ⇒ “3.6.27 Outside Air Temperature Sensor G17 , Checking”, page 259 . – Check the CAN-Bus terminal resistance. Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 .
P0073 Ambient Air Temperature Sensor Circuit "A" High	Ambient Air Temperature Sensor Circuit High	• Error message sent from cluster to ECU	• Communication time after T15 on > 1.0 s	• 2.0 s	• 2 DCY	– Check the Outside Air Temperature Sensor - G17- . Refer to ⇒ “3.6.27 Outside Air Temperature Sensor G17 , Checking”, page 259 . – Check the CAN-Bus terminal resistance. Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0087 Fuel Rail/System Pressure - Too Low Bank 1	Fuel Rail Pressure Control Too Low	• Control deviation > 150.0 – 200.0 Bar • Exceeding absolute rail pressure limits < 120.0 – 125.0 Bar	• Closed loop rail pressure control	• 800.0 ms • Continuous	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ “3.1 Preliminary Check”, page 16 and/or to appropriate repair manual. – Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.6.21 Fuel Pressure Sensor G247 , Checking”, page 246 . – Check the Fuel Metering Valve - N290- . Refer to ⇒ “3.6.19 Fuel Metering Valve N290 , Checking”, page 242 . – Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ “3.6.20 Fuel Pressure Regulator Valve N276 , Checking”, page 244 . – Check the Fuel Delivery Unit - GX1- / Fuel Pump Relay - J17- . Refer to ⇒ “3.6.17 Fuel Delivery Unit GX1 / Fuel

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
						Pump Relay J17 , Checking", page 238 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0088 Fuel Rail/ System Pressure - Too High Bank 1	Fuel Rail Pressure Control Too High	• Control deviation < -200.0 – -300.0 Bar • Exceeding absolute rail pressure limits > 1,950.0 Bar	• Closed loop rail pressure control • Delay-time for detection of a defect metering-unit > 90.0 s after engine start	• 240.0 ms • Continuous	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ “3.1 Preliminary Check”, page 16 and/or to appropriate repair manual. – Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.6.21 Fuel Pressure Sensor G247, Checking”, page 246 . – Check the Fuel Metering Valve - N290- . Refer to ⇒ “3.6.19 Fuel Metering Valve N290 , Checking”, page 242 . – Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ “3.6.20 Fuel Pressure Regulator Valve N276 , Checking”, page 244 . – Check the Fuel Delivery Unit - GX1- / Fuel Pump Relay - J17- . Refer to ⇒ “3.6.17 Fuel Delivery Unit GX1 / Fuel

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
						Pump Relay J17 , Checking", page 238 .
P0090 Fuel Pressure Regulator "A" Control Circuit/ Open	Fuel Pressure Regulator Circuit Open	• Signal Voltage < 4.7 V	• ECM power stage = permanently high	• 0.26 s • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ "3.6.20 Fuel Pressure Regulator Valve N276 , Checking", page 244 . – Check the Fuel Metering Valve - N290- . Refer to ⇒ "3.6.19 Fuel Metering Valve N290 , Checking", page 242 . – Check the Fuel Delivery Unit - GX1- / Fuel Pump Relay - J17- . Refer to ⇒ "3.6.17 Fuel Delivery Unit GX1 / Fuel Pump Relay J17 , Checking", page 238 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0091 Fuel Pressure Regulator "A" Control Circuit Low	Fuel Pressure Regulator Circuit Short To Ground	• Signal Voltage < 2.97 V	• ECM power stage = permanently high	• 0.26 s • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ “3.6.20 Fuel Pressure Regulator Valve N276 , Checking”, page 244 . – Check the Fuel Metering Valve - N290- . Refer to ⇒ “3.6.19 Fuel Metering Valve N290, Checking”, page 242 . – Check the Fuel Delivery Unit - GX1- / Fuel Pump Relay - J17- . Refer to ⇒ “3.6.17 Fuel Delivery Unit GX1 / Fuel Pump Relay J17 , Checking”, page 238 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0092 Fuel Pressure Regulator "A" Control Circuit High	Fuel Pressure Regulator Control Circuit Short To Battery Voltage	• Signal current > 3.0 A	• ECM power stage = permanently low	• 0.26 s • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ “3.6.20 Fuel Pressure Regulator Valve N276 , Checking”, page 244 . – Check the Fuel Metering Valve - N290- . Refer to ⇒ “3.6.19 Fuel Metering Valve N290 , Checking”, page 242 . – Check the Fuel Delivery Unit - GX1- / Fuel Pump Relay - J17- . Refer to ⇒ “3.6.17 Fuel Delivery Unit GX1 / Fuel Pump Relay J17 , Checking”, page 238 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P00AF Turbocharger/Supercharger Boost Control "A" Module Performance	Charge Air Pressure Dynamic Response	• Characteristic value (amplitude of air mass) < 1.0 – 1.7%	• Boost pressure = 715.0 – 1,100.0 hPa • Engine RPM < 1,000 RPM • Vehicle speed = 0 MPH • APP = 0.0% • Torque Demand = < 5.0 Nm • Friction moment (calculated) < 80.0 Nm • Ambient temperature > -20° C • ECT > 60° C • Throttle valve position = 90.0 – 105.0% • Difference between target and actual idle speed < 100 RPM • DPF regeneration mode = off	• 10.0 s	• 2 DCY	– Check the Exhaust Door Control Unit - J883- . Refer to ⇒ “3.6.14 Exhaust Door Control Unit J883 , Checking”, page 232 . – Check the Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ “3.6.34 Wastegate Bypass Regulator Valve N75 , Checking”, page 274 . – Check the Charge Air Pressure Actuator Position Sensor - G581- . Refer to ⇒ “3.6.6 Charge Air Pressure Actuator Position Sensor G581 , Checking”, page 216 .
		• Actuator stuck open > 17.0% • Actuator stuck closed < 17.0%	• Time after start > 9.6 min	• 16.0 s		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P00C6 Fuel Rail Pressure Too Low - Engine Cranking Bank 1	Fuel Rail Pressure Control Monitoring Of Fuel Pressure During Engine Start (Cranking)	• Fuel rail pressure is < 120.0 – 180.0 bar	• Ambient temperature > -7° C • Battery voltage before cranking 9.5 V • Ambient pressure > 740.0 hPa • Engine speed > 75 RPM • Engine condition = cranking	• 9.5 s • Continuous	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ “3.1 Preliminary Check”, page 16 and/or to appropriate repair manual. – Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.6.21 Fuel Pressure Sensor G247 , Checking”, page 246 . – Check the Fuel Metering Valve - N290- . Refer to ⇒ “3.6.19 Fuel Metering Valve N290 , Checking”, page 242 . – Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ “3.6.20 Fuel Pressure Regulator Valve N276 , Checking”, page 244 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P00D1 HO2S Heater Control Circuit Range/ Performance Bank 1 Sensor 1	HO2 Sensor Heater Control Performance	• Battery voltage < exhaust gas flow rate, exhaust gas temperature at sensor element • Sensor temperature < 720° C	• Heater control = active • Ambient temperature > -10° C • Baro > 750.0 hPa • Battery voltage > 10.7 V • Modeled dew point = exceeded	• 20.0 min. (up and down debouncing)	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 .
P00D2 HO2S Heater Control Circuit Range/ Performance Bank 1 Sensor 2	O2S Bank 1 Sensor 2 Heater Output Warm Up Time Exceeded	• Battery voltage < f (exhaust gas flow rate, exhaust gas temperature at sensor element) • Sensor temperature < 720° C	• Ambient temperature > -10° C • Baro > 750.0 hPa • Battery voltage > 10.7 V • LSU heater control active • Modeled dew point exceeded	• 20.0 min. up and down debouncing	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 261 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P00D5 HO2S Sensor Correlation Bank 1 Sensor 1 / Bank 1 Sensor 2	HO2 Sensor 1 And HO2 Sensor 2 Offset Adaption	• Offset air fuel ratio > 0.05 [-]	• Battery voltage > 10.7 V • Heater control = active • Modeled dew point = exceeded • Requirements for adaptation: • Multiple phases with high and low lambda (total duration of 48.0 s at fuel-cut off and total duration of 77.0 s at engine speed > 750 RPM and < 930 RPM; inj. quantity > 2.0 mg/stroke and < 10.0 mg/stroke; air mass > 200.0 mg/stroke and < 350.0 mg/stroke, calc. lambda < 2.5; coolant temp. > 65° C) are required. EWMA filtering over 10 idle phases.	• 48.0 – 77.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 . – Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 261 .
P0101 Mass or Volume Air Flow Sensor "A" Circuit Range/ Performance	Mass Air Flow Circuit Plausibility Check	• Plausibility check by model air mass min. • Ratio of model air mass and actual airflow mass < 0.84 [-] • Plausibility check by model air mass max. • Ratio of model air mass and actual airflow mass > 1.8 [-]	• Engine running • EGR valve > 99.5% • Fuel quantity < 0.2 mg/stroke • Engine speed > 1,000 or < 2,500 RPM • ECT > 59.96° C • Exhaust throttle valve > 89.5 and < 100.5% • EGR valve low pressure > 99.5% • Intake flap > -1.0 and < 10.0% • Throttle valve > 99.0 and < 100.5%	• 10.0 s • 8.0 s	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 . – Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 . – Check the Mass Airflow

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Mass Air Flow Circuit Range Check High Temp. Calculated Value	• PWM signal period time > 60.0 ms	• Engine running • Battery voltage > 9.5 V	• 600.0 ms		Sensor - G70- . Refer to ⇒ “3.6.26 Mass Airflow Sensor G70 , Checking”, page 257 .
	Mass Air Flow Circuit Range Check Low Temp. Calculated Value	• PWM signal period time < 40.0 ms				
P0102 Mass or Volume Air Flow Sensor "A" Circuit Low	Mass Air Flow Circuit Low Input	• Range check low calculated value: • PWM signal period time > 83 µs (854.0 kg/h)	• Engine running • Delay time after engine running > 1,000.0 ms • Battery voltage > 9.5 V	• 2,000.0 ms	• 2 DCY	– Check the Mass Airflow Sensor - G70- . Refer to ⇒ “3.6.26 Mass Airflow Sensor G70 , Checking”, page 257 . – Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 .
		• Range check low raw value: • PWM signal period time > 71.4 µs (900.0 kg/h)	• Engine speed > 600 RPM • Delay Time after Engine running > 1,000.0 ms • Battery voltage > 9.5 V	• 600.0 ms		
P0103 Mass or Volume Air Flow Sensor "A" Circuit High	Mass Air Flow Circuit High Input	• Range check high calculated value: • PWM signal period time > > 667.0 µs (-57.0 kg/h)	• Engine running • Delay time after engine running > 1,000.0 ms • Battery voltage > 9.5 V	• 2,000.0 ms • Continuous	• 2 DCY	– Check the Mass Airflow Sensor - G70- . Refer to ⇒ “3.6.26 Mass Airflow Sensor G70 , Checking”, page 257 . – Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 .
		• Range check high raw value: • Raw value PWM signal period time > 833,35 µs (-150 kg/h)		• 600.0 ms • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0111 Intake Air Temperature Sensor 1 Circuit Range/ Performance Bank 1	Intake Air Temperature Sensor Circuit Performance	• Temperature difference to at least 3 other temperature sensors at startup > 30 K	• Engine off time > 32,400.0 s • IAT change after engine start < 5 K • AAT change after engine start < 5 K • Driving speed > 25 mph • decrease of coolant temperature 1 or 2 after engine start < 5 K (2 K in case of block heater installation coded)	• 20.0 s • Continuous	• 2 DCY	– Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 . – Check the Mass Airflow Sensor - G70- . Refer to ⇒ “3.6.26 Mass Airflow Sensor G70 , Checking”, page 257 .
P0112 Intake Air Temperature Sensor 1 Circuit Low Bank 1	Intake Air Temperature Sensor Circuit Short To Ground	• Signal voltage < 0.04 V	• Engine running	• 480.0 ms	• 2 DCY	– Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 . – Check the Mass Airflow Sensor - G70- . Refer to ⇒ “3.6.26 Mass Airflow Sensor G70 , Checking”, page 257 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0113 Intake Air Temperature Sensor 1 Circuit High Bank 1	Intake Air Temperature Sensor Circuit Open Or Short To Battery voltage	• Signal voltage > 2.88 V	• Engine running	• 480.0 ms	• 2 DCY	– Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 . – Check the Mass Airflow Sensor - G70- . Refer to ⇒ “3.6.26 Mass Airflow Sensor G70 , Checking”, page 257 .
P0116 Engine Coolant Temperature Sensor 1 Circuit Range/ Performance	Engine Coolant Temperature Sensor Circuit Warm Up Time Plausibility	• Time for coolant temp to reach 19.96° C or increase by 10 K => 300.0 s for start temp. < 10° C • Or • > 120.0 s for start temp > 10° C	• ECT start temp. < 19.96° C • EST sensors = no faults • Note: timer is paused if engine speed < 1,400 RPM or fuel quantity < 9.0 mg / Stroke	• (See threshold values)	• 2 DCY	– Check the Engine Coolant Temperature Sensor - G62- . Refer to ⇒ “3.6.11 Engine Coolant Temperature Sensor G62 , Checking”, page 226 .
P0117 Engine Coolant Temperature Sensor 1 Circuit Low	Engine Coolant Temperature Sensor Circuit Short To Ground	• Signal voltage < 0.15 V		• 480.0 ms • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor - G62- . Refer to ⇒ “3.6.11 Engine Coolant Temperature Sensor G62 , Checking”, page 226 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0118 Engine Coolant Temperature Sensor 1 Circuit High	Engine Coolant Temperature Sensor Circuit Open Or Short To Battery Voltage	• Signal voltage > 3.25 V		• 480.0 ms • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor - G62- . Refer to ⇒ “3.6.11 Engine Coolant Temperature Sensor G62 , Checking”, page 226 .
P0121 Throttle/ Pedal Position Sensor/ Switch "A" Circuit Range/ Performance	Throttle/ Pedal Position Sensor/ Switch "A" Circuit Range/ Performance	• Signal voltage > 1.0 V and/or < 0.4 V	• ECT > -19.94° C and/or < 120° C • Battery voltage > 10.0 V	• 200.0 ms	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .
P0122 Throttle/ Pedal Position Sensor/ Switch "A" Circuit Low	Throttle/ Pedal Position Sensor/ Switch "A" Circuit Low	• Signal voltage > 4.85 V		• 480.0 ms	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .
P0123 Throttle/ Pedal Position Sensor/ Switch "A" Circuit High	Throttle/ Pedal Position Sensor/ Switch "A" Circuit High	• Signal voltage < 150.0 mV		• 480.0 ms	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0128 Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	Thermostat Temperature Below Control Range	• Measured temperature < 70° C • Modeled temperature > 80° C	• ECT at start < 59.96° C and/or > -10.4° C • Engine speed > 500 RPM • Testing time < 900.0 s • ECT = no fault • IAT = no fault • VSS = no fault • Model release conditions: • Increase of ECT > 3 K • Time since release conditions are met > 300.0 s • Restart condition: ECT drops after io thermostat test below < 59.96° C	• 900.0 s (if restart conditions are met) • Continuous	• 2 DCY	– Check the engine coolant thermostat. Refer to appropriate repair manual. – Check the Engine Coolant Temperature Sensor - G62- . Refer to ⇒ “3.6.11 Engine Coolant Temperature Sensor G62 , Checking”, page 226 . – Check the Engine Coolant Temperature Sensor On Radiator Outlet - G83- . Refer to ⇒ “3.6.12 Engine Coolant Temperature Sensor On Radiator Outlet G83 , Checking”, page 228 .
P0130 O2 Sensor Circuit Bank 1 Sensor 1	O2 Sensor Circuit Bank 1 Sensor 1	• Virtual ground (VM) > 3.0 V • Nernst voltage (UN) > 4.0 V • Adjustment voltage (IP) > 1.5 V	• HO2 heater temperature > 720° C • Battery voltage > (exhaust gas flow, exhaust gas temperature at sensor element)	• 2.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 .
	Short To Ground	• Virtual ground (VM) < 2.0 V • Nernst voltage (UN) < 1.75 V • Adjustment voltage (IP) < 0.3 V				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0132 O2 Sensor Circuit High Voltage Bank 1 Sensor 1	O2 Sensor Circuit High Voltage Bank 1 Sensor 1	• Signal voltage > 3.2 V	• HO2 heater = active • Modeled dew point = exceeded • HO2 heater temp between > 720° C and/or < 840° C • Battery voltage > 10.7 V	• 2.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 .
P0133 O2 Sensor Circuit Slow Response Bank 1 Sensor 1	O2 Sensor Circuit Slow Response Bank 1 Sensor 1	• Time to 30.0% of expected concentration increase > 2.6 s • Or • Time to 60.0% minus time to 30.0% > 1.5 s • Or • Time to 60.0% of expected concentration increase > 4.1 s	• Heater control and fuel cutoff = active • Fuel quantity before transition to fuel cutoff > 6.0 mg/stroke • Change in fuel quantity before transition to fuel cutoff over period of 1.0 s < 2.0 mg/stroke • Calculated oxygen concentration before transition < 12.0% vol / vol • Duration of transition to fuel cutoff < 1.1 s • Battery voltage > 10.7 V • Engine speed > 1,400 RPM • Duration of transition plus duration of fuel cutoff > 4.1 s • 2 fuel cutoff phases: (each of duration > 4.1 s) that satisfy enable conditions.	• 8.5 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 .
P0135 O2 Sensor Heater Circuit Bank 1 Sensor 1	O2 Sensor Heater Circuit Bank 1 Sensor 1	• HO2S ceramic temp. > 840° C	• No fuel cut off > 0.1 s • Dew point = exceeded	• 30.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Con-

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
er Circuit Bank 1 Sensor 1		• HO2S ceramic temp. < 720° C	• Calibration of internal resistance = not active • Heater control closed loop	• 60.0 s • Continuous		verter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 .
	Short To Battery voltage	• Signal current > 2.2 A		• 5.0 s • Continuous		
	Short To Ground	• Signal voltage < 2.15 V				
	Open	• Signal voltage > 4.4 V				
P0136 O2 Sensor Circuit Bank 1 Sensor 2	O2 Sensor Circuit Bank 1 Sensor 2	• Virtual ground (VM) > 3.0 V • Nernst voltage (UN) > 4.0 V • Adjustment voltage (IP) > 1.5 V	• Sensor element temperature > 720° C • Battery voltage > exhaust gas flow, exhaust gas temperature at sensor element	• 2.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 261 .
	Short To Ground	• Virtual ground (VM) < 2.0 V • Nernst voltage (UN) < 1.75 V • Adjustment voltage (IP) < 0.3 V				
	Dynamic Check Virtual Ground (VM)	• Virtual ground (VM) internal resistance > 1,104.0 Ω • Internal signal voltage < 1.4 V and/or > 1.6 V	• HO2 Sensor Heater temperature > 720° C • Battery voltage = exhaust gas flow, exhaust gas temperature at sensor element	• 4.0 s • Continuous		
	Dynamic Check Nernst Voltage (UN)	• Nernst voltage (UN) internal resistance > 1,104.0 Ω • Internal signal voltage > 3.0 V				
	Dynamic Check Pump Current (IP)	• Pump current (IP) < 0.005 [-]	• Calculated oxygen concentration > 0.07 [-] • Fuel cutoff = not active • Battery voltage > 10.7 V	• 5.0 s • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0138 O2 Sensor Circuit High Voltage Bank 1 Sensor 2	O2 Sensor Circuit High Voltage Bank 1 Sensor 2	• Signal voltage > 3.2 V	• HO2 heater = active • Modeled dew point = exceeded • HO2 heater temp between > 720° C and/or < 840° C • Battery voltage > 10.7 V	• 2.0 [-] • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 261 .
P0139 O2 Sensor Circuit Slow Response Bank 1 Sensor 2	O2 Sensor Circuit Slow Response Bank 1 Sensor 2	• Time to 30.0% of expected concentration increase > 2.6 s • Or • Time to 60.0% minus time to 30.0% > 1.5 s • Or • Time to 60.0% of expected concentration increase > 4.1 s	• Heater control and fuel cutoff = active • Fuel quantity before transition to fuel cutoff > 6 mg/stroke • Change in fuel quantity before transition to fuel cutoff over period of 1.0 s < 2.0 mg/stroke • Calculated oxygen concentration before transition < 12.0% vol / vol • Duration of transition to fuel cutoff < 1.1 s • Battery voltage > 10.7 V • Engine speed > 1,400 RPM • Duration of transition plus duration of fuel cutoff > 4.1 s • 2 fuel cutoff phases: (each of duration > 4.1 s) that satisfy enable conditions	• 8.5 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 261 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P013B O2 Sensor Slow Response - Lean To Rich Bank 1 Sensor 2	O2 Sensor Slow Response - Lean To Rich Bank 1 Sensor 2	• Time delay between oxygen signals pre and post NOx trap > 1.5 s (1. sensor later than 2. sensor) • Time delay between oxygen signals pre and post NOx trap > 0.45 – 0.72 s = (exhaust gas mass flow) (2. sensor later than 1. sensor)	• Demand for NOx trap = on • Adaptation of oxygen sensor pre and post NOx trap = realized • Dew point release oxygen sensor signals pre and post NOx trap = on • Oxygen sensor signals pre and post NOx-trap < 1.1 [-] • Torque (LP on) off: < 60.0 Nm (1,000 – 2,000 RPM) 25.0 Nm (2,250 – 2,500 RPM) 65.0 Nm (2,800 RPM) on: > 80.0 Nm (1,100 – 2,000 RPM) 45.0 Nm (2,250 – 2,500 RPM) 85.0 Nm (2,700 RPM) in dependence of environmental pressure (750.0 – 1,000.0 hPa), shown values taken at 1,000.0 hPa off: < 160.0 – 270.0 Nm (1,000 – 1,500 RPM) 300 Nm (1,750 – 2,500 RPM) 265.0 Nm (2,800 RPM) On: > 200.0 – 290.0 Nm (1,100 – 1,500 RPM) 320.0 Nm (1,750 – 2,500 RPM) 295.0 Nm (2,700 RPM) in dependence of environmental pressure (750 – 1,000.0 hPa), shown values taken at 1,000.0 hPa • Temperature of upstream turbine < 850° C	• 45.0 mins (3 regeneration events)	• 2DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 261 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Fuel temp < 90° C • APP > 1 and < 100.0% • Gear = 2 • Engine run time > 240.0 s • Exhaust gas flow > 100.0 and < 200.0 kg/h			
P0141 O2 Sensor Heater Circuit Bank 1 Sensor 2	O2 Sensor Heater Circuit Bank 1 Sensor 2	• HO2S ceramic temp. > 840° C	• No fuel cut off > 0.1 s • Dew point = exceeded • Calibration of internal resistance = not active • Heater control closed loop	• 30.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 261 .
		• HO2S ceramic temp. < 720° C		• 60.0 s • Continuous		
	Short To Battery voltage	• Signal current > 2.2 A		• 5.0 s • Continuous		
	Short To Ground	• Signal voltage < 2.15 V				
	Open	• Signal voltage > 4.4 V				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P014D O2 Sensor Circuit Slow Response Bank 1 Sensor 1	O2 Sensor Slow Response - Lean To Rich Bank 1 Sensor 1	• Time delay between oxygen signals pre and post NOx trap > 1.5 s (1. sensor later than 2. sensor • Time delay between oxygen signals pre and post NOx trap > 0.45 – 0.72 s = (exhaust gas mass flow) (2. sensor later than 1. sensor)	• Demand for NOx trap = on • Adaptation of oxygen sensor pre and post NOx trap = realized • Dew point release oxygen sensor signals pre and post NOx trap = on • Oxygen sensor signals pre and post NOx-trap < 1.1 [-] • Torque (LP on) off: < 60.0 Nm (1,000 – 2,000 RPM) 25.0 Nm (2,250 – 2,500 RPM) 65.0 Nm (2,800 RPM) on: > 80.0 Nm (1,100 – 2,000 RPM) 45.0 Nm (2,250 – 2,500 RPM) 85.0 Nm (2,700 RPM) in dependence of environmental pressure (750.0 – 1,000.0 hPa), shown values taken at 1,000.0 hPa off: < 160.0 – 270.0 Nm (1,000 – 1,500 RPM) 300 Nm (1,750 – 2,500 RPM) 265.0 Nm (2,800 RPM) On: > 200.0 – 290.0 Nm (1,100 – 1,500 RPM) 320.0 Nm (1,750 – 2,500 RPM) 295.0 Nm (2,700 RPM) in dependence of environmental pressure (750 – 1,000.0 hPa), shown values taken at 1,000.0 hPa • Temperature of upstream turbine < 850° C	• 45.0 mins. (3.0 regeneration events)	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
			• Fuel temp < 90° C • APP > 1 and < 100.0% • Gear = 2 • Engine run time > 240.0 s • Exhaust gas flow > 100.0 and < 200.0 kg/h			
P0181 Fuel Temperature Sensor "A" Circuit Range/ Performance	Fuel Temperature Sensor Circuit Range / Performance	• Temperature difference to at least 3 other temperature sensors at startup > 30 K	• Engine off time > 9.0 hr • IAT change after engine start < 5 K • ECT sensor 1 or 2 < 30° C • Decrease of coolant temperature 1 or 2 after engine start < 5 K	• 60.0 s including 20.0 s continuous driving with velocity exceeding 25 mph • Continuous	• 2 DCY	– Check the Fuel Temperature Sensor - G81- . Refer to ⇒ “3.6.23 Fuel Temperature Sensor G81 , Checking”, page 251 .
P0182 Fuel Temperature Sensor "A" Circuit Low	Fuel Temperature Sensor Circuit Short To Ground	• Signal voltage < 0.05 V		• 480.0 ms	• Once / DCY • 2 DCY	– Check the Fuel Temperature Sensor - G81- . Refer to ⇒ “3.6.23 Fuel Temperature Sensor G81 , Checking”, page 251 .
P0183 Fuel Temperature Sensor "A" Circuit High	Fuel Temperature Sensor Circuit Open Or Short To Battery Voltage	• Signal voltage > 4.7 V		• 480.0 ms • Once / DCY	• 2 DCY	– Check the Fuel Temperature Sensor - G81- . Refer to ⇒ “3.6.23 Fuel Temperature Sensor G81 , Checking”, page 251 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0191 Fuel Rail Pressure Sensor Circuit Range/ Performance Bank 1	Fuel Pressure Sensor Circuit Offset Detection During Keep Alive Time	• Signal voltage < 0.409 V or > 0.620 V	• Engine condition: ignition off, engine off, ECM still on	• 100.0 ms	• 2 DCY	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.6.21 Fuel Pressure Sensor G247 , Checking”, page 246 .
	Fuel Pressure Sensor Circuit Adaptation Of Pressure Control Valve (PCV)	• Adaptation value out of limit > 130.0% or < 83.0%	• Fuel temperature > -7° C or < 60° C • Rail pressure set point > 500.0 bar or < 1,300.0 bar • Gradient of rail pressure set point < 800.0 bar/s • Gradient of PCV current set point < 300.0 mA/s	• < 80.0 s		
P0192 Fuel Rail Pressure Sensor Circuit Low Bank 1	Fuel Pressure Sensor Circuit Short To Ground	• Signal voltage < 200.0 mV		• 140.0 ms • Continuous	• 2 DCY	– Check the Fuel Pressure Sensor - G247- . Refer to ⇒ “3.6.21 Fuel Pressure Sensor G247 , Checking”, page 246 .
P0193 Fuel Rail Pressure Sensor Circuit High Bank 1	Fuel Pressure Sensor Circuit Short To Battery Voltage	• Signal voltage > 4.8 V		• 140.0 ms • Continuous	• 2 DCY • y	– Check Fuel Pressure Sensor - G247- . Refer to ⇒ “3.6.21 Fuel Pressure Sensor G247 , Checking”, page 246 .
P0201 Cylinder 1 Injector "A" Circuit	Cylinder 1 Injector Circuit Open	• Signal voltage > 60.0 V	• Injector valve = switched on	• 4 [injections] • Continuous	• 2 DCY	– Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0202 Cylinder 2 Injector "A" Circuit	Cylinder 2 Injector Circuit Open	• Signal voltage > 60.0 V	• Injector valve = switched on	• 4 [injections] • Continuous	• 2 DCY	– Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .
P0203 Cylinder 3 Injector "A" Circuit	Cylinder 3 Injector Circuit Open	• Signal voltage > 60.0 V	• Injector valve = switched on	• 4 [injections] • Continuous	• 2 DCY	– Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .
P0204 Cylinder 4 Injector "A" Circuit	Cylinder 4 Injector Circuit Open	• Signal voltage > 60.0 V	• Injector valve = switched on	• 4 [injections] • Continuous	• 2 DCY	– Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .
P020A Cylinder 1 Injection Timing	Cylinder 1 Injection Timing	• Control error < limit from MAP (engine speed and desired torque) -8° CA to -4° CA • Or • Control error < limit from MAP (engine speed and desired torque) +8° CA to +4° CA	• Engine running • ECM in closed loop • ECT > 50° C • Baro > 750.0 hPa • Time since engine start > 30.0 s • Regeneration = off	• 120 rev	• 2 DCY	– Check Fuel Injectors. Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 . – Check Camshaft Position Sensor -G40- Refer to ⇒ “3.6.3 Camshaft Position Sensor G40 , Checking”, page 209 – Check Engine Speed Sensor -G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P020B Cylinder 2 Injection Timing	Cylinder 2 Injection Timing	• Control error < limit from MAP (engine speed and desired torque) -8° CA to -4° CA • Or • Control error < limit from MAP (engine speed and desired torque) +8° CA to +4° CA	• Engine running • ECM in closed loop • ECT > 50° C • Baro > 750.0 hPa • Time since engine start > 30.0 s • Regeneration = off	• 120 rev	• 2 DCY	– Check Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 . – Check Camshaft Position Sensor - G40- Refer to ⇒ “3.6.3 Camshaft Position Sensor G40 , Checking”, page 209 – Check Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P020C Cylinder 3 Injection Timing	Cylinder 3 Injection Timing	• Control error < limit from MAP (engine speed and desired torque) -8° CA to -4° CA • Or • Control error < limit from MAP (engine speed and desired torque) +8° CA to +4° CA	• Engine running • ECM in closed loop • ECT > 50° C • Baro > 750.0 hPa • Time since engine start > 30.0 s • Regeneration = off	• 120 rev	• 2 DCY	– Check Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 . – Check Camshaft Position Sensor - G40- Refer to ⇒ “3.6.3 Camshaft Position Sensor G40 , Checking”, page 209 – Check Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P020D Cylinder 4 Injection Timing	Cylinder 4 Injection Timing	• Control error < limit from MAP (engine speed and desired torque) -8° CA to -4° CA • Or • Control error < limit from MAP (engine speed and desired torque) +8° CA to +4° CA	• Engine running • ECM in closed loop • ECT > 50° C • Baro > 750.0 hPa • Time since engine start > 30.0 s • Regeneration = off	• 120 rev	• 2 DCY	– Check Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 . – Check Camshaft Position Sensor G40- Refer to ⇒ “3.6.3 Camshaft Position Sensor G40 , Checking”, page 209 – Check Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 .
P0234 Turbocharger/ Supercharger "A" Overboost Condition	Charge Air Boost Pressure Rationality Check Low	• Absolute value of control deviation > -300.0 – -800.0 hPa	• Engine running • Time after start > 96.0 s	• 7.0 s • Continuous	• 2 DCY	– Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 . – Check the Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ “3.6.34 Wastegate Bypass Regulator Valve N75 , Checking”, page 274 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0236 Manifold Absolute Pressure/ Barometric Pressure Sensor Circuit Range/ Performance	Charge Air Pressure Sensor Circuit Plausibility Check	• Difference between barometric and boost pressure signal > 150.0 hPa	• Engine speed < 50 RPM • Baro/MAP = no faults • Ambient pressure signal = no fault	• 540.0 ms	• 2 DCY	– Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 . – Check the Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ “3.6.34 Wastegate Bypass Regulator Valve N75 , Checking”, page 274 .
P0237 Turbocharger/ Supercharger Boost Sensor "A" Circuit Low	Charge Air Pressure Sensor Circuit Short To Ground	• Signal voltage < 0.68 V	• Engine running	• 480.0 ms	• 2 DCY	– Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 . – Check the Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ “3.6.34 Wastegate Bypass Regulator Valve N75 , Checking”, page 274 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0238 Turbocharger/ Supercharger Boost Sensor "A" Circuit High	Charge Air Pressure Sensor Circuit Open Or Short To Battery Voltage	• Signal voltage > 4.88 V	• Engine running	• 480.0 ms	• 2 DCY	– Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 . – Check the Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ “3.6.34 Wastegate Bypass Regulator Valve N75 , Checking”, page 274 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0263 Cylinder 1 Contribution/ Balance	Cylinder 1 Zero Fuel Calibration (Monitoring Of Zero Fuel Calibration Values)	• Calibration value of injector energizing time > 217 µs or < 117 µs (at 1,400.0 bar rail pressure)	• Enable conditions for adaptation: • Engine speed > 1,050 RPM or < 2,000 RPM (1,400 RPM with 6 Gear MT) • Fuel temperature > 0° C or < 80° C • Intake air temp > 0° C • ECT > 70° C • Boost pressure > 880.0 hpa • Gear 3, 4, 5 or 6th • Engine condition: fuel cutoff and inactive regeneration • Absolute value of rail pressure deviation < 50.0 bar (set point = 1,400.0 bar)	• Adaptation: ≤ 2.0 UDC cycles • Continuous	• 1 DCY	– Check for an engine mechanical fault with a cylinder compression test. Carbon buildup may cause a higher than normal compression reading and may contribute to this concern. Refer to appropriate repair manual for low compression readings or for carbon buildup removal. – Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ "3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking", page 205 . – Check the Fuel Injectors . Refer to ⇒ "3.6.18 Fuel Injectors , Checking", page 240 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0266 Cylinder 2 Contribution/ Balance	Cylinder 2 Zero Fuel Calibration (Monitoring Of Zero Fuel Calibration Values)	• Calibration value of injector energizing time > 217 µs or < 117 µs (at 1,400.0 bar rail pressure)	• Enable conditions for adaption: • Engine speed > 1,050 RPM or < 2,000 RPM (1,400 RPM with 6 Gear MT) • Fuel temperature > 0° C or < 80° C • Intake air temp > 0° C • ECT > 70° C • Boost pressure > 880.0 hpa • Gear 3, 4, 5 or 6th • Engine condition: fuel cutoff and inactive regeneration • Absolute value of rail pressure deviation < 50.0 bar (set point = 1,400.0 bar)	• Adaption: ≤ 2.0 UDC cycles • Continuous	• 1 DCY	– Check for an engine mechanical fault with a cylinder compression test. Carbon buildup may cause a higher than normal compression reading and may contribute to this concern. Refer to appropriate repair manual for low compression readings or for carbon buildup removal. – Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 . – Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0269 Cylinder 3 Contribution/ Balance	Cylinder 3 Zero Fuel Calibration (Monitoring Of Zero Fuel Calibration Values)	• Calibration value of injector energizing time > 217 µs or < 117µs (at 1,400.0 bar rail pressure).	• Enable conditions for adaption: • Engine speed > 1,050 RPM or < 2,000 RPM (1,400 RPM with 6 Gear MT) • Fuel temperature > 0° C or < 80° C • Intake air temp > 0° C • ECT > 70° C • Boost pressure > 880.0 hpa • Gear 3, 4, 5 or 6th • Engine condition: fuel cutoff and inactive regeneration • Absolute value of rail pressure deviation < 50.0 bar (set point = 1,400.0 bar)	• Adaption: ≤ 2.0 UDC cycles • Continuous	• 1 DCY	– Check for an engine mechanical fault with a cylinder compression test. Carbon buildup may cause a higher than normal compression reading and may contribute to this concern. Refer to appropriate repair manual for low compression readings or for carbon buildup removal. – Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 . – Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P026A Charge Air Cooler Efficiency Below Threshold	Charge Air Cooler Efficiency Below Threshold	• Charge air intercooler efficiency < 0.4 [-]	• ECT > 60° C • Vehicle speed > 40 MPH • Boost pressure vs. barometric > 1.0 hPa • Charge air flow rate > 60.0 and/or < 400.0 kg/h • Ambient temp > -7° C and/or < 50° C • Baro > 750.0 hPa • Fuel quantity > 1.0 mg/stroke • Gear = not reverse	• 245.0 s • Once / DCY	• 2 DCY	– Check the air to air intercooler in front of the radiator for debris obstructing the cooling fins, restricted or collapsed hoses, damaged or missing lower fascia or splash shield. Correct the condition and clear the DTC. Test drive vehicle. – Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0272 Cylinder 4 Contribution/ Balance	Cylinder 4 Zero Fuel Calibration (Monitoring Of Zero Fuel Calibration Values)	• Calibration value of injector energizing time > 217 µs or < 117 µs (at 1,400.0 bar rail pressure)	• Enable conditions for adaption: • Engine speed > 1,050 RPM or < 2,000 RPM (1,400 RPM with 6 Gear MT) • Fuel temperature > 0° C or < 80° C • Intake air temp > 0° C • ECT > 70° C • Boost pressure > 880.0 hpa • Gear 3, 4, 5 or 6th • Engine condition: fuel cutoff and inactive regeneration • Absolute value of rail pressure deviation < 50.0 bar (set point = 1,400.0 bar)	• Adaption: ≤ 2.0 UDC cycles • Continuous	• 1 DCY	– Check for an engine mechanical fault with a cylinder compression test. Carbon buildup may cause a higher than normal compression reading and may contribute to this concern. Refer to appropriate repair manual for low compression readings or for carbon buildup removal. – Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 . – Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0299 Turbocharger/ Supercharger "A" Underboost Condition	Charge Air Boost Pressure Rationality Check High	• Absolute value of control deviation > 400.0 – 800.0 hPa	• Engine running • Time after start > 96.0 s	• 7.5 s • Continuous	• 2 DCY	– Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 . – Check the Wastegate Bypass Regulator Valve - N75- . Refer to ⇒ “3.6.34 Wastegate Bypass Regulator Valve N75 , Checking”, page 274 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0300 Random/ Multiple Cylinder Misfire Detected	Misfire Detected Multiple Cylinder	• Rise in engine speed after fuel injection: Calculated based on values from last two engine revolutions • Error threshold: 180 counts over 440 crankshaft revolutions	• Engine speed > 750 RPM • Engine speed < 1,100 RPM • Fuel quantity > 2.5 mg/stroke • Fuel quantity < 25.0 mg/stroke • ECT, > 30° C • Time since start > 5,000.0 ms • Time since clutch status change, > 1,000.0 ms	• < 880 engine rev	• Once / DCY • 2 DCY	– Check for an engine mechanical fault with a cylinder compression test. Carbon buildup may cause a higher than normal compression reading and may contribute to this concern. Refer to appropriate repair manual for low compression readings or for carbon buildup removal. – Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ “3.1 Preliminary Check”, page 16 and/or to appropriate repair manual. – Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 . – Check the Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
						– Check the Camshaft Position Sensor - G40- . Refer to ⇒ “3.6.3 Camshaft Position Sensor G40 , Checking”, page 209 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0301 Cylinder 1 Misfire Detected	Cylinder 1 Misfire Detected	• Misfire rate within 1,000 engine revolutions > 10.0% • Misfire event detection if actual inner torque < 2.5 Nm	• Engine speed > 770 RPM • Engine speed < 4,000 RPM • Fuel quantity > 4.8 mg/stroke • ECT, > -7° C • ECT, < 120° C • IAT, >-7° C • Time since start > 5,000.0 ms • Time since positive engine torque desire > 1,000.0 ms • Desire inner torque > 45.0 Nm. • Environmental pressure > 750.0 hPa.	• < 880 engine rev • Once / DCY	• 2 DCY	– Check for an engine mechanical fault with a cylinder compression test. Carbon buildup may cause a higher than normal compression reading and may contribute to this concern. Refer to appropriate repair manual for low compression readings or for carbon buildup removal. – Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ “3.1 Preliminary Check”, page 16 and/or to appropriate repair manual. – Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 . – Check the Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
						– Check the Camshaft Position Sensor - G40- . Refer to ⇒ “3.6.3 Camshaft Position Sensor G40 , Checking”, page 209 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0302 Cylinder 2 Misfire Detected	Cylinder 2 Misfire Detected	• Misfire rate within 1,000 engine revolutions > 10.0% • Misfire event detection if actual inner torque < 2.5 Nm	• Engine speed > 770 RPM • Engine speed < 4,000 RPM • Fuel quantity > 4.8 mg/stroke • ECT, > -7° C • ECT, < 120° C • IAT, >-7° C • Time since start > 5,000.0 ms • Time since positive engine torque desire > 1,000.0 ms • Desire inner torque > 45.0 Nm. • Environmental pressure > 750.0 hPa.	• < 880 engine rev • Once / DCY	• 2 DCY	– Check for an engine mechanical fault with a cylinder compression test. Carbon buildup may cause a higher than normal compression reading and may contribute to this concern. Refer to appropriate repair manual for low compression readings or for carbon buildup removal. – Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ “3.1 Preliminary Check”, page 16 and/or to appropriate repair manual. – Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 . – Check the Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
						– Check the Camshaft Position Sensor - G40- . Refer to ⇒ “3.6.3 Camshaft Position Sensor G40 , Checking”, page 209 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0303 Cylinder 3 Misfire Detected	Cylinder 3 Misfire Detected	• Misfire rate within 1,000 engine revolutions > 10.0% • Misfire event detection if actual inner torque < 2.5 Nm	• Engine speed > 770 RPM • Engine speed < 4,000 RPM • Fuel quantity > 4.8 mg/stroke • ECT, > -7° C • ECT, < 120° C • IAT, >-7° C • Time since start > 5,000.0 ms • Time since positive engine torque desire > 1,000.0 ms • Desire inner torque > 45.0 Nm. • Environmental pressure > 750.0 hPa.	• < 880 engine rev • Once / DCY	• 2 DCY	– Check for an engine mechanical fault with a cylinder compression test. Carbon buildup may cause a higher than normal compression reading and may contribute to this concern. Refer to appropriate repair manual for low compression readings or for carbon buildup removal. – Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ “3.1 Preliminary Check”, page 16 and/or to appropriate repair manual. – Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 . – Check the Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
						– Check the Camshaft Position Sensor - G40- . Refer to ⇒ “3.6.3 Camshaft Position Sensor G40 , Checking”, page 209 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0304 Cylinder 4 Misfire Detected	Cylinder 4 Misfire Detected	• Misfire rate within 1,000 engine revolutions > 10.0% • Misfire event detection if actual inner torque < 2.5 Nm	• Engine speed > 770 RPM • Engine speed < 4,000 RPM • Fuel quantity > 4.8 mg/stroke • ECT, > -7° C • ECT, < 120° C • IAT, >-7° C • Time since start > 5,000.0 ms • Time since positive engine torque desire > 1,000.0 ms • Desire inner torque > 45.0 Nm. • Environmental pressure > 750.0 hPa.	• < 880 engine rev • Once / DCY	• 2 DCY	– Check for an engine mechanical fault with a cylinder compression test. Carbon buildup may cause a higher than normal compression reading and may contribute to this concern. Refer to appropriate repair manual for low compression readings or for carbon buildup removal. – Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ “3.1 Preliminary Check”, page 16 and/or to appropriate repair manual. – Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 . – Check the Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
						– Check the Camshaft Position Sensor - G40- . Refer to ⇒ “3.6.3 Camshaft Position Sensor G40 , Checking”, page 209 .
P0321 Ignition/ Distributor Engine Speed Input Circuit Range/ Performance	Engine Speed Input Circuit Rationality Check	• Consecutive not plausible signals > 15.0 [-] • Cam phase signals without plausible signal > 4 cam rotations • Monitoring reference gap = failure	• Engine running time > 15.0 s	• 8 engine revs • Continuous	• 2 DCY	– Check the Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 . – Check the Camshaft Position Sensor - G40- . Refer to ⇒ “3.6.3 Camshaft Position Sensor G40 , Checking”, page 209 .
P0322 Ignition/ Distributor Engine Speed Input Circuit No Signal	Engine Speed Input Circuit No Signal	• Camshaft signals > 3.0 [-] • Crankshaft signals = no signal	• Engine running time > 15.0 s	• 8 engine revs	• 2 DCY	– Check the Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 . – Check the Camshaft Position Sensor - G40- . Refer to ⇒ “3.6.3 Camshaft Position Sensor G40 , Checking”, page 209 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0381 Glow Plug/ Heater Indicator Control Circuit/ Open	Glow Plug Control Indicator Lamp Circuit (Wait To Start)	• Not equal with lamp request bit (via CAN)	• Battery voltage > 9.0 V • Glow system active	• 350.0 ms • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 . – Check the Data Bus On Board Diagnostic Interface - J533- . Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 .
P0383 Glow Plug Control Module 1 Control Circuit Low	Glow Plug Time Control Module Control Circuit Short To Ground	• Signal voltage < 200.0 mV	• Glow system = not active	• 500.0 ms • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P0401 EGR "A" Flow Insufficient Detected	EGR System Rationality Check Low Flow Detected	• Control deviation: EGR < -45.0 – -200.0 g/rev	• EGR mode closed loop • Fuel quantity > 2.0 or < 30.0 mg • Engine speed > 800 or < 3,100 RPM	• 5.0 – 10.0 s	• 2 DCY	– Check the EGR Valve 1 - GX5- . Refer to ⇒ “3.6.9 EGR Valve 1 GX5 , Checking”, page 222 . – Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0402 EGR "A" Flow Excessive Detected	EGR System Rationality Check Excessive Flow Detected	• Mass air flow ratio calculated from: mass air flow measured vs. mass air flow modeled > 1.16 [-]	• Engine condition = running • EGR mode closed loop • Fuel quantity > 2.0 or < 30.0 mg • Engine speed > 1,000 or < 2,600 RPM • ECT 59.96° C • Exhaust flap motor 100.50% and/or > 89.50% • LP EGR > 99.50% • Intake runner flap < 10.0% and/or > -1.0 %	• 5.0 – 10.0 s • Continuous	• 2 DCY	– Check the EGR Valve 1 - GX5- . Refer to ⇒ “3.6.9 EGR Valve 1 GX5 , Checking”, page 222 . – Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .
P0403 EGR "A" Control Circuit/ Open	HP EGR Actuator Circuit Open	• Signal voltage > 0.8 V or < 2.0 V	• ECM power stage = off	• 0.6 s	• 2 DCY	– Check the EGR Valve 1 - GX5- . Refer to ⇒ “3.6.9 EGR Valve 1 GX5 , Checking”, page 222 . – Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .
	HP EGR Actuator Circuit Short To Ground Or Malfunction Error	• Signal current > 8.0 A – 18.0 A	• ECM power stage = on	• 0.5 s		
	HP EGR Actuator Circuit Short To Battery Voltage					
	HP EGR Actuator Circuit Functional Check: Stuck Close	• Stuck valve > 20.0%	• Control deviation > 10.0% or < -10.0%	• 3.0 s		
	HP EGR Actuator Circuit Functional Check: Stuck Open	• Stuck valve > 20.0%				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0405 EGR Sensor "A" Circuit Low	HP EGR Position Sensor Circuit Short To Ground	• Signal voltage < 150.0 mV	• Position sensor signal > 4,850.0 mV • Position sensor signal < 150.0 mV	• 0.5 s	• 2 DCY	– Check the EGR Valve 1 - GX5- . Refer to ⇒ “3.6.9 EGR Valve 1 GX5 , Checking”, page 222 . – Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .
P0406 EGR Sensor "A" Circuit High	HP EGR Position Sensor Circuit Short To Battery Voltage	• Signal voltage > 4.80 V	• Position sensor signal > 4850 mV • Position sensor signal < 150 mV	• 0.5 s	• 2 DCY	– Check the EGR Valve 1 - GX5- . Refer to ⇒ “3.6.9 EGR Valve 1 GX5 , Checking”, page 222 . – Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .
P040B EGR Temperature Sensor "A" Circuit Range/ Performance	Exhaust Gas Recirculation Temperature Sensor Circuit Plausibility Check	• Sensor temperature < 55° C • Or • Temperature difference to other temperature sensors during cold start < 45 K	• Time engine running > 3.0 min • ECT > 70° C • Simulated sensor temp > 85° C • Elapsed time since LP EGR valve open > 30.0 s • Characteristic for heat flow balance of EGR LP cooler system exceeds lower threshold	• 10.0 s	• 2 DCY	– Check the EGR Temperature Sensor - G98- . Refer to ⇒ “3.6.8 EGR Temperature Sensor G98 , Checking”, page 220 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P040C EGR Temperature Sensor "A" Circuit Low	Exhaust Gas Recirculation Temperature Sensor Circuit Short To Ground	• Signal voltage < 0.06 V	• Engine running	• 480.0 ms	• 2 DCY	– Check the EGR Temperature Sensor - G98- . Refer to ⇒ "3.6.8 EGR Temperature Sensor G98 , Checking", page 220 .
P040D EGR Temperature Sensor "A" Circuit High	Exhaust Gas Recirculation Temperature Sensor Circuit Open Or Short To Battery Voltage	• Signal voltage > 3.24 V	• Engine running	• 10.0 min	• 2 DCY	– Check the EGR Temperature Sensor - G98- . Refer to ⇒ "3.6.8 EGR Temperature Sensor G98 , Checking", page 220 .
P0420 Catalyst System Efficiency Below Threshold Bank 1	NMHC Oxidation Catalyst System Functional Check: Conversion Efficiency	• Ratio of measured and modeled heat quantity < 0.3 [-]	• Regeneration demand for PM trap = On • Minimum HC injection mass to start monitoring sequence > 0.1 kg/h • Difference between model and sensor temperature of downstream oxidation catalyst > 50 K or < -50 K • Average HC injection during PM trap regeneration > 0.1 g/s • Accumulated HC injection mass > 50.0 g • Engine speed 1,250 – 4,000 RPM	• 0.0 s • Multiple	• 1 DCY	– Check the Oxygen Sensor 1 after Catalytic Converter - GX7- . Refer to ⇒ "3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking", page 261 . – Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ "3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking", page 264 .
P045A EGR "B"	LP EGR Actuator Circuit Open Or	• Signal voltage > 0.8 V or < 2.0 V	• ECM power stage = off	• 0.6 s • Continuous	• 2 DCY	– Check the EGR Valve 2 - GX6- . Refer to

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
Control Circuit	Malfunction Error	• Signal current > 8.0 A – 18.0 A	• ECM power stage = on	• 0.5 s • Continuous		⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .
P045B EGR "B" Control Circuit Range/ Performance	LP EGR Actuator Circuit Position Sensor Signal In Desired Range (Closed)	• Signal voltage > 1.0 V or < 0.4 V	• ECT > -19.94° C or < 120° C • Battery voltage > 10.0 V	• 200.0 ms	• 2 DCY	– Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .
P045C EGR "B" Control Circuit Low	LP EGR Actuator Circuits Short To Ground	• Signal current > 8.0 A – 18.0 A	• ECM power stage = on	• 0.5 s • Continuous	• 2 DCY	– Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .
P045D EGR "B" Control Circuit High	LP EGR Actuator Circuits Short To Battery Voltage	• Signal current > 8.0 A – 18.0 A	• ECM power stage = on	• 0.5 s • Continuous	• 2 DCY	– Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .
P045E EGR "B" Control Stuck Open	LP EGR Position Sensor Circuit EGR Stuck Open	• Comparison of actual and desired position signal: • EGR valve stuck (open) > 12.0%	• Control deviation > 10.0% or < -10.0%	• 3.0 s	• 2 DCY	– Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .
P045F EGR "B" Control Stuck Closed	LP EGR Position Sensor Circuit EGR Stuck Closed	• Comparison of actual and desired position signal: • EGR valve stuck (closed) < 12.0%	• Control deviation > 10.0% or < -10.0%	• 3.0 s	• 2 DCY	– Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P046C EGR Sensor "A" Circuit Range/Performance	HP EGR Actuator Circuit Position Sensor Signal In Desired Range (Closed)	• Signal Voltage > 1.0 V or < 0.4 V	• ECT > -19.94° C or < 120° C • Battery voltage > 10.0 V	• 200.0 ms	• 2 DCY	– Check the EGR Valve 1 - GX5- . Refer to ⇒ “3.6.9 EGR Valve 1 GX5 , Checking”, page 222 .
P0470 Exhaust Pressure Sensor "A" Circuit	Differential Pressure Sensor Circuit Open Or Short To Battery Voltage	• Signal voltage > 4.9 V		• 480.0 ms	• 2 DCY	– Check the Differential Pressure Sensor - G505- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 .
P0471 Exhaust Pressure Sensor "A" Circuit Range/Performance	Differential Pressure Sensor Circuit Dynamic Check	• Detection of false connected hose lines: • Differential of pressure signal < -30.0 hPa	• ECT > 59.96° C	• 5.0 s	• 2 DCY	– Check the Differential Pressure Sensor - G505- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 .
		• Offset detection during after-run: • Differential of pressure signal < -27.0 and/or > 47.0 hPa	• Engine = after run • ECT > 59.96° C	• 500.0 ms		
P0472 Exhaust Pressure Sensor "A" Circuit Low	Differential Pressure Sensor Circuit Short To Ground	• Signal voltage < 0.2 V		• 480.0 ms	• 2 DCY	– Check the Differential Pressure Sensor - G505- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0473 Exhaust Pressure Sensor "A" Circuit High	Differential Pressure Sensor Circuit Open Or Short To Battery	• Signal voltage > 4.9 V		• 480.0 ms	• 2 DCY	– Check the Differential Pressure Sensor - G505- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 .
P0474 Exhaust Pressure Sensor "A" Circuit Intermittent/ Erratic	Exhaust Pressure Sensors Circuit Detection Of A Disconnected	• Difference between modeled and actual pressure differential across low pressure EGR > 40 hPa	• ECT > 59.96 and/or < 149.96° C • Ambient pressure > 780.0 hPa • Filtered, simulated pressure down stream of particle filter > 40.0 hPa • Exhaust flap motor < 78.0% (closed) • LP EGR valve > 84.0% (closed) • Engine speed > 800 and/or < 3,500 RPM	• 5.0 s	• 2 DCY	– Check the Differential Pressure Sensor - G505- . Refer to ⇒ “3.6.7 Differential Pressure Sensor G505 , Checking”, page 218 . – Check the Exhaust Pressure Sensor 1 - G450- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 .
P0475 Exhaust Pressure Control Valve "A"	Exhaust Door Control Unit Circuit Open	• Signal voltage > 0.8 V or < 2.0 V	• ECM power stage = off	• 0.6 s	• 2 DCY	– Check the Exhaust Door Control Unit - J883- . Refer to ⇒ “3.6.14 Exhaust Door Control Unit J883 , Checking”, page 232 .
	Exhaust Door Control Unit Circuit Malfunction Error	• Signal current > 8.0 A – 18.0 A	• ECM power stage = on	• 0.5 s		
P0477 Exhaust Pressure Control Valve "A" Low	Exhaust Door Control Unit Circuit Short To Ground	• Signal current > 8.0 A – 18.0 A	• ECM power stage = on	• 0.5 s	• 2 DCY	– Check the Exhaust Door Control Unit - J883- . Refer to ⇒ “3.6.14 Exhaust Door Control Unit J883 , Checking”, page 232 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0478 Exhaust Pressure Control Valve "A" High	Exhaust Door Control Unit Circuit Short To Battery Voltage	• Signal current > 8.0 A – 18.0 A	• ECM power stage = on	• 0.5 s	• 2 DCY	– Check the Exhaust Door Control Unit - J883- . Refer to ⇒ “3.6.14 Exhaust Door Control Unit J883 , Checking”, page 232 .
P047F Exhaust Pressure Control Valve "A" Stuck Open	Exhaust Door Control Unit Circuit Stuck Open	• Exhaust door flap stuck open < 10.0%	• Control deviation < -10.0%	• 33.0 s	• 2 DCY	– Check the Exhaust Door Control Unit - J883- . Refer to ⇒ “3.6.14 Exhaust Door Control Unit J883 , Checking”, page 232 .
P0486 EGR Sensor "B" Circuit	LP EGR Position Sensor Circuit Open	• Signal voltage > 4.7 V		• 480.0 ms	• 2 DCY	– Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .
	LP EGR Position Sensor Circuit Short To Ground	• Signal voltage < 0.21 V				
P048A Exhaust Pressure Control Valve "A" Stuck Closed	Exhaust Door Control Unit Circuit Stuck Closed	• Exhaust door flap stuck closed > 10.0%	• Control deviation > 10.0%	• 33.0 s	• 2 DCY	– Check the Exhaust Door Control Unit - J883- . Refer to ⇒ “3.6.14 Exhaust Door Control Unit J883 , Checking”, page 232 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P048B Exhaust Pressure Control Valve "A" Position Sensor/Switch Circuit	Exhaust Flap Position Sensor Circuit Short To Ground	• Signal voltage < 0.25 V		• 0.5 s	• 2 DCY	– Check the Exhaust Flap Control Module - J883- . Refer to ⇒ "3.6.14 Exhaust Door Control Unit J883 , Checking", page 232 .
P048C Exhaust Pressure Control Valve "A" Position Sensor/Switch Circuit Range/Performance	Exhaust Door Control Unit Circuit Position Sensor Signal In Desired Range (Closed)	• Position sensor signal in desired range during closed position learning > 1.1 V or < 0.5 V	• Coolant temperature > 49.96° C or < 120.0° C • Battery voltage > 10.0 V	• 200.0 ms	• 2 DCY	– Check the Exhaust Door Control Unit - J883- . Refer to ⇒ "3.6.14 Exhaust Door Control Unit J883 , Checking", page 232 .
P048E Exhaust Pressure Control Valve "A" Position Sensor/Switch Circuit High	Exhaust Flap Position Sensor Circuit Short To Battery Voltage	• Signal voltage > 4.85 V		• 0.5 s	• 2 DCY	– Check the Exhaust Flap Control Module - J883- . Refer to ⇒ "3.6.14 Exhaust Door Control Unit J883 , Checking", page 232 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0501 Vehicle Speed Sensor "A" Circuit Range/ Performance	Vehicle Speed Sensor Performance	• Brake control unit error message sent		• 500.0 ms	• 2 DCY	– Check the vehicle speed signal. Refer to ⇒ “3.6.33 Vehicle Speed Signal, Checking”, page 272 . – Check the CAN-Bus terminal resistance. Refer to ⇒ “3.6.4 CAN-Bus Terminal Resistance, Checking”, page 211 .
P0502 Vehicle Speed Sensor "A" Circuit Low	Vehicle Speed Sensor Circuit Low Input	• Brake control unit error message sent		• 500.0 ms	• 2 DCY	– Check the vehicle speed signal. Refer to ⇒ “3.6.33 Vehicle Speed Signal, Checking”, page 272 . – Check the CAN-Bus terminal resistance. Refer to ⇒ “3.6.4 CAN-Bus Terminal Resistance, Checking”, page 211 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0503 Vehicle Speed Sensor "A" Circuit Intermittent/ Erratic/ High	Vehicle Speed Sensor Intermittent High Signal	• Vehicle speed > 320 km/h	• VSS signal not defective	• 500.0 ms	• 2 DCY	– Check the vehicle speed signal. Refer to ⇒ “3.6.33 Vehicle Speed Signal, Checking”, page 272 . – Check the CAN-Bus terminal resistance. Refer to ⇒ “3.6.4 CAN-Bus Terminal Resistance, Checking”, page 211 .
P0506 Idle Control System RPM - Lower Than Expected	Idle Control System RPM Lower Than Expected	• Control deviation < 10.0%	• ECT sensor > -7.04° C and/or < 106.96° C • Accelerator pedal position = 0.0 [-]	• 25.0 s	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .
P0507 Idle Control System RPM - Higher Than Expected	Idle Control System RPM Higher Than Expected	• Control deviation > 10.0%	• Engine running	• 25.0 s	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .
P050E Cold Start Engine Exhaust Temperature Too Low	Cold Start Engine Exhaust Temperature Too Low	• Sensor temperature < 170° C	• Ambient temperature > -20 °C • Engine speed > 1,125 RPM • Fuel quantity > 15.0 mg/stroke • Model temperature > 230° C	• 600.0 s accumulated time while comparison is active • Once / DCY	• 2 DCY	– Check Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 . – Check the Exhaust Flap Control

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Control deviation > limit from map (engine speed, torque)	• CSERS = on • temperature control loop = on (temp. upstream turbine > 200° C) • Temperature upstream particulate matter trap > 100° C • fuel quantity > 10 mg/stroke and/or < 45 mg/stroke • engine speed > 1100 rpm and/or < 3500 rpm • ECT > 25 °C and/or < 70 °C • torque > 50 Nm and/or < 300 Nm • Gear > 2nd • Ambient temperature > -20 °C • Baro > 750 hPa	• 30.0 s	• 1 DCY	Module - J883- . Refer to ⇒ “3.6.14 Exhaust Door Control Unit J883 , Checking”, page 232 .
P0534 A/C Refrigerant Charge Loss	Vehicle Speed Sensor Intermittent / Erratic / High			• 480.0 ms	• 2 DCY	– Check the vehicle speed signal. Refer to ⇒ “3.6.33 Vehicle Speed Signal, Checking”, page 272 .
P0544 Exhaust Gas Temperature Sensor Circuit Bank 1 Sensor 1	Exhaust Gas Temperature Sensor Circuit (Upstream Turbocharger) Open Or Short To Battery Voltage	• Signal voltage > 1.72 V	• Engine running	• 480.0 ms	• 2 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0545 Exhaust Gas Temperature Sensor Circuit Low Bank 1 Sensor 1	Exhaust Gas Temperature Sensor Circuit (Upstream Turbocharger) Short To Ground	• Signal voltage < 0.45 V	• Engine running	• 480.0 ms	• 2 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .
P054E Idle Control System - Fuel Quantity Lower Than Expected	Idle Control System Fuel Quantity Higher Than Expected	• Fuel quantity < 0.004 g/rev	• Engine condition = running • ECT > 55° C • Vehicle speed < 1.0 MPH • Engine speed > 750 RPM and/or < 1,500 RPM • Accelerator pedal position = 0.0 [-] • Ambient temperature > -10° C • Ambient pressure > 750.0 hPa	• 10.0 s • Multiple	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .
P054F Idle Control System - Fuel Quantity Higher Than Expected	Idle Control System Fuel Quantity Lower Than Expected	• Fuel quantity > 0.0182 – 0.0325 g/rev	• Engine condition = running • ECT > 55° C • Vehicle speed < 1.0 MPH • Engine speed > 750 RPM and/or < 1,500 RPM • Accelerator pedal position = 0.0 [-] • Ambient temperature > -10° C • Ambient pressure > 750.0 hPa	• 10.0 s • Multiple	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0562 System Voltage Low	System Voltage Low Voltage	• Internal check failure of voltage supply for ECM off timer	• Engine shut off • Power on reset	• 6 DCY	• 1 DCY	– Check the Terminal 30 Power Supply Relay - J317- . Refer to ⇒ “3.6.30 Terminal 30 Power Supply Relay J317 , Checking”, page 267 . – Check the powers and grounds to the Engine Control Module - J623- . If all are ok, then replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0604 Internal Control Module Random Access Memory (RAM) Error	EEPROM Memory Error	• EEPROM could not be erased - data still available • Write EEPROM not possible • Checksum error in 3 or more locations		• 1.0 s	• 2 DCY	– Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0605 Internal Control Module Memory Checksum Error	ECM Internal Test Error	• ECM internal self test failed		• 1.0 s • Continuous	• 2 DCY	– Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0606 ECM/PCM Processor	Internal Control Module Memory Check Sum Error	• ECM internal self test failed		• 1.0 s • Continuous	• 2 DCY	– Replace the Engine Control Module - J623- . Refer to appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0607 Control Module Performance	Control Module Performance	• ECM internal self test failed	• LSU raw signal calibration = active	• 1.0 s	• 2 DCY	– Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P0627 Fuel Pump "A" Control Circuit/ Open	Fuel Pump Circuit Open	• Signal current < 0.8 mA	• Fuel pump commanded off	• 270.0 – 480.0 ms • Continuous	• 2 DCY	– Check the Fuel Delivery Unit - GX1- / Fuel Pump Relay - J17- . Refer to ⇒ “3.6.17 Fuel Delivery Unit GX1 / Fuel Pump Relay J17 , Checking”, page 238 .
P0628 Fuel Pump "A" Control Circuit Low	Fuel Pump Circuit Short To Ground	• Signal voltage < 2.0 V	• Fuel pump commanded off	• 270.0 – 480.0 ms • Continuous	• 2 DCY	– Check the Fuel Delivery Unit - GX1- / Fuel Pump Relay - J17- . Refer to ⇒ “3.6.17 Fuel Delivery Unit GX1 / Fuel Pump Relay J17 , Checking”, page 238 .
P0629 Fuel Pump "A" Control Circuit High	Fuel Pump Circuit Short To Battery Voltage	• Signal current > 1.0 A	• Fuel pump commanded on	• 270.0 – 480.0 ms • Continuous	• 2 DCY	– Check the Fuel Delivery Unit - GX1- / Fuel Pump Relay - J17- . Refer to ⇒ “3.6.17 Fuel Delivery Unit GX1 / Fuel Pump Relay J17 , Checking”, page 238 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0634 Control Module Internal Temperature "A" Too High	ECM Internal Temperature Too High	• Output driver temperature too high >150° C	• Output driver = active	• 480.0 ms • Continuous	• 2 DCY	– Check the Fuel Delivery Unit - GX1- / Fuel Pump Relay - J17- . Refer to ⇒ “3.6.17 Fuel Delivery Unit GX1 / Fuel Pump Relay J17 , Checking”, page 238 .
P0638 Throttle Actuator Control Range/ Performance Bank 1	Throttle Valve Actuator Control Motor Circuit Internal Error	• Diagnostic signal from actuator module = defective state		• 2.5 s	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .
P0641 Sensor Reference Voltage "A" Circuit/ Open	Sensor Reference Voltage "A" Circuit Open	• Sensor supply voltage < 4.8 V or > 5.2 V		• 90.0 ms	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P064C Glow Plug Control Module 1	Glow Plug Time Control Module Circuit Wrong Calibration	• Number of cylinders is unequal to ECU application or • Glow plug type is unequal to ECU application	• Glow system = active	• 1.0 s • Continuous • 3.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0651 Sensor Reference Voltage "B" Circuit/ Open	Sensor Reference Voltage "B" Circuit Open	• Sensor supply voltage < 4.8 V or > 5.2 V		• 90.0 ms	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P066A Cylinder 1 Glow Plug Control Circuit Low	Glow Plug Cylinder 1 Circuit Short To Battery Voltage	• Signal current > 70.0 A	• Glow system active • Demand signal 8.0 – 95.0% • Battery voltage > 9.0 V	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P066C Cylinder 2 Glow Plug Control Circuit Low	Glow Plug Cylinder 2 Circuit Short To Battery Voltage	• Signal current > 70.0 A	• Glow system active • Demand signal 8.0 – 95.0% • Battery voltage > 9.0 V	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P066E Cylinder 3 Glow Plug Control Circuit Low	Glow Plug Cylinder 3 Circuit Short To Battery Voltage	• Signal current > 70.0 A	• Glow system active • Demand signal 8.0 – 95.0% • Battery voltage > 9.0 V	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0670 Glow Plug Control Module 1 Control Circuit/ Open	Glow Plug Time Module Control Circuit Open Or Short To Battery Voltage	• Signal voltage > 3.44 V	• Glow system = not active	• 500.0 ms • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P0671 Cylinder 1 Glow Plug Circuit/ Open	Glow Plug Cylinder 1 Circuit Open Or Short To Ground	• Signal current < 2.2 A	• Glow system active • Demand signal 8.0 – 95.0% • Battery voltage > 9.0 V	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P0672 Cylinder 2 Glow Plug Circuit/ Open	Glow Plug Cylinder 2 Circuit Open Or Short To Ground	• Signal current < 2.2 A	• Glow system active • Demand signal 8.0 – 95.0% • Battery voltage > 8.0 V	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P0673 Cylinder 3 Glow Plug Circuit/ Open	Glow Plug Cylinder 3 Circuit Open Or Short To Ground	• Signal current < 2.2 A	• Glow system active • Demand signal 8.0 – 95.0% • Battery voltage > 8.0 V	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P0674 Cylinder 4 Glow Plug Circuit/ Open	Glow Plug Cylinder 4 Circuit Open Or Short To Ground	• Signal current < 2.2 A	• Glow system active • Demand signal 8.0 – 95.0% • Battery voltage > 8.0 V	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P067A Cylinder 4 Glow Plug Control Circuit Low	Glow Plug Cylinder 4 Circuit Short To Battery Voltage	• Signal current > 70.0 A	• Glow system active • Demand signal 8.0 – 95.0% • Battery voltage > 9.0 V	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P0684 Glow Plug Control Module 1 to PCM Communication Circuit Range/ Performance	Glow Plug Time Control Module Circuit No PCM Communication	• Missing communication from the Glow Control Unit	• ECT < 30° C	• 3.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 . – Check the CAN-Bus terminal resistance. Refer to ⇒ “3.6.4 CAN-Bus Terminal Resistance, Checking”, page 211 .
		• Automatic Glow Time Control Module = Error Message	• Glow system = active	• 50.0 s • Continuous		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P068A ECM/PCM Power Relay De-Energized Performance - Too Early	ECM Power Relay Performance - Open To Early	• Internal test		• 10 times	• 2 DCY	– Check the Terminal 30 Power Supply Relay - J317- . Refer to ⇒ “3.6.30 Terminal 30 Power Supply Relay J317 , Checking”, page 267 .
P068B ECM/PCM Power Relay De-Energized Performance - Too Late	ECM Power Relay Performance - Stuck	• Internal test		• 500.0 ms	• 2 DCY	– Check the Terminal 30 Power Supply Relay - J317- . Refer to ⇒ “3.6.30 Terminal 30 Power Supply Relay J317 , Checking”, page 267 .
P0697 Sensor Reference Voltage "C" Circuit/Open	Sensor Reference Voltage "C" Circuit Open	• Sensor supply voltage < 3.168 V or > 3.432 V		• 50.0 ms	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.
P06A3 Sensor Reference Voltage "D" Circuit/Open	Sensor Reference Voltage "D" Circuit/Open	• Sensor supply voltage < 2.97 V or > 3.63 Vr		• 50.0 ms	• 2 DCY	– If a related sensor voltage code is also set, refer to that sensor for diagnosis first. If no other related codes set, replace the Engine Control Module - J623- . Refer to appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P06B9 Cylinder 1 Glow Plug Circuit Range/ Performance	Glow Plug Cylinder 1 Resistance Check	• Glow plug resistance time interval after glow start: • 4.0 – 9.0 s (< 0.3 Ω) • 9.0 – 14.0 s (< 0.4 Ω) • After 14.0 s (< 0.5 Ω) • Anytime (> 1.2 Ω)	• Glow system active • Demand signal 8.0 – 95.0% • Battery voltage > 9.0 V	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P06BA Cylinder 2 Glow Plug Circuit Range/ Performance	Glow Plug Cylinder 2 Resistance Check	• Glow plug resistance time interval after glow start: • 4.0 – 9.0 s (< 0.3 Ω) • 9.0 – 14.0 s (< 0.4 Ω) • After 14.0 s (< 0.5 Ω) • Anytime (> 1.2 Ω)	• Glow system active • Demand signal 8.0 – 95.0% • Battery voltage > 9.0 V	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P06BB Cylinder 3 Glow Plug Circuit Range/ Performance	Glow Plug Cylinder 3 Resistance Check	• Glow plug resistance time interval after glow start: • 4.0 – 9.0 s (< 0.3 Ω) • 9.0 – 14.0 s (< 0.4 Ω) • After 14.0 s (< 0.5 Ω) • Anytime (> 1.2 Ω)	• Glow system active • Demand signal 8.0 – 95.0% • Battery voltage > 9.0 V	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P06BC Cylinder 4 Glow Plug Circuit Range/ Performance	Glow Plug Cylinder 4 Resistance Check	• Glow plug resistance time interval after glow start: • 4.0 – 9.0 s (< 0.3 Ω) • 9.0 – 14.0 s (< 0.4 Ω) • After 14.0 s (< 0.5 Ω) • Anytime (> 1.2 Ω)	• Glow system active • Demand signal 8.0 – 95.0% • Battery voltage > 9.0 V	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P06C5 Cylinder 1 Glow Plug Incorrect	Glow Plug Cylinder 1 Incorrect Type	• Wrong current slope	• Glow system = active • ECT < 18° C • ECM off time >= 900.0 s • Demand signal = 95.0%	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P06C6 Cylinder 2 Glow Plug Incorrect	Glow Plug Cylinder 2 Incorrect Type	• Wrong current slope	• Glow system = active • ECT < 18° C • ECM off time >= 900.0 s • Demand signal = 95.0%	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P06C7 Cylinder 3 Glow Plug Incorrect	Glow Plug Cylinder 3 Incorrect Type	• Wrong current slope	• Glow system = active • ECT < 18° C • ECM off time >= 900.0 s • Demand signal = 95.0%	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P06C8 Cylinder 4 Glow Plug Incorrect	Glow Plug Cylinder 4 Incorrect Type	• Wrong current slope	• Glow system = active • ECT < 18° C • ECM off time >= 900.0 s • Demand signal = 95.0%	• 8.0 s • Continuous	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P06FE Cold Start Diesel Intake Air Flow Control Performance	Cold Start Diesel Intake Air Flow Control Performance	• Valve stuck open > 12.0%	• Control deviation > 10.0% or < -10.0%	• 3.0 s	• 2 DCY	– Check the Throttle Valve Control Module - J338- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .
P1004 Torque Difference Cylinder 1 Limit Value Exceeded	Torque Difference Cylinder 1 Limiting Value Exceeded	• Control error < limit from MAP f (engine speed and desired torque) -50.0 to -30.0 Nm Or +50.0 to +30.0 Nm	• Engine running • ECM in closed loop • ECT > 50° C • Baro > 750 hPa • Time since engine start > 30.0 s • Regeneration = off	• 120 rev	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ “3.1 Preliminary Check”, page 16 and/or to appropriate repair manual. – Check Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 . – Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P1005 Torque Difference Cylinder 2 Limit Value Exceeded	Torque Difference Cylinder 2 Limiting Value Exceeded	• Control error < limit from MAP f (engine speed and desired torque) -50.0 to -30.0 Nm Or +50.0 to +30.0 Nm	• Engine running • ECM in closed loop • ECT > 50° C • Baro > 750.0 hPa • Time since engine start > 30.0 s • Regeneration = off	• 120 rev	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ “3.1 Preliminary Check”, page 16 and/or to appropriate repair manual. – Check Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 . – Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P1006 Torque Difference Cylinder 3 Limit Value Exceeded	Torque Difference Cylinder 3 Limiting Value Exceeded	• Control error < limit from MAP f (engine speed and desired torque) -50.0 to -30.0 Nm Or +50.0 to +30.0 Nm	• Engine running • ECM in closed loop • ECT > 50° C • Baro > 750.0 hPa • Time since engine start > 30.0 s • Regeneration = off	• 120 rev	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ “3.1 Preliminary Check”, page 16 and/or to appropriate repair manual. – Check Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 . – Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P1007 Torque Difference Cylinder 4 Limit Value Exceeded	Torque Difference Cylinder 4 Limiting Value Exceeded	• Control error < limit from MAP f (engine speed and desired torque) -50.0 to -30.0 Nm Or +50.0 to +30.0 Nm	• Engine running • ECT > 50° C • Baro > 750.0 hPa • Time since engine start > 30.0 s • Regeneration = off	• 120 rev	• 2 DCY	– Check the fuel pressure and delivery quantity. Refer to fuel system mechanical testing in ⇒ “3.1 Preliminary Check”, page 16 and/or to appropriate repair manual. – Check Engine Speed Sensor - G28- . Refer to ⇒ “3.6.13 Engine Speed Sensor G28 , Checking”, page 230 . – Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .
P13CE Sensor For Internal Pressure Of Cylinder 1 Electrical Error	Cylinder 1 Pressure Sensor Circuit Short To Battery Voltage	• Signal voltage > 3.17 V	• Engine = running	• 40 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P13CF Sensor For Internal Pressure Of Cylinder 1 Short Circuit To Ground	Cylinder 1 Pressure Sensor Circuit Short To Ground	• Cylinder pressure sensor voltage < 0.13 V	• Engine = running	• 40 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P13D0 Sensor For Internal Pressure Of Cylinder 1 Implausible Signal	Cylinder 1 Pressure Sensor Circuit Out Of Range	• Signal voltage < 0.33 V and/or > 3.09 V	• Engine = running	• 1,000 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
	Cylinder 1 Constant Pressure	• Deviation between maximum and minimum cylinder pressure sensor 1 < 20 bar	• Engine condition = running • Throttle valve = open • Barometric > 750.0 hPa			
	Cylinder 1 Pressure Sensor Offset	• Offset out of range < -7.0 bar and/or > 7.0 bar				
	Cylinder 1 Plausibility With Calculated Pressure	• Difference between calculated cylinder pressure, based on intake air pressure and compression ratio, and measured cylinder pressure sensor #1 out of range < -10.0 bar and/or > 10.0 bar	• Engine condition = fuel cut off • Throttle valve = open • LP EGR valve = closed • HP EGR valve = closed • IAT = > -2° C and/or < 44° C • ECT = > 60° C and/or < 100° C	• 40 revolutions		

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P13D1 Sensor For Internal Pressure Of Cylinder 2 Electrical Error	Cylinder 2 Pressure Sensor Circuit Open Or Short To Battery Voltage	• Signal voltage > 3.17 V	• Engine = running	• 40 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P13D2 Sensor For Internal Pressure Of Cylinder 2 Short Circuit To Ground	Cylinder 2 Pressure Sensor Circuit Short To Ground	• Signal voltage < 0.13 V	• Engine = running	• 40 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P13D3 Sensor For Internal Pressure Of Cylinder 2 Implausible Signal	Cylinder 2 Pressure Sensor Circuit Out Of Range	• Signal voltage < 0.33 V and/or > 3.09 V	• Engine = running	• 1,000 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
	Cylinder 2 Constant Pressure	• Deviation between maximum and minimum cylinder pressure sensor 1 < 20.0 bar	• Engine condition = running • Throttle valve = open • Barometric > 750.0 hPa			
	Cylinder 2 Pressure Sensor Offset	• Offset out of range < -7.0 bar and/or > 7.0 bar				

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
	Cylinder 2 Plausibility With Calculated Pressure	• Difference between calculated cylinder pressure, based on intake air pressure and compression ratio, and measured cylinder pressure sensor #1 out of range < -10.0 bar and/or > 10.0 bar	• Engine condition = fuel cut off • Throttle valve = open • LP EGR valve = closed • HP EGR valve = closed • IAT = > -2° C and/or < 44° C • ECT = > 60° C and/or < 100° C	• 40 revolutions		
P13D4 Sensor For Internal Pressure Of Cylinder 3 Electrical Error	Cylinder 3 Pressure Sensor Circuit Open Or Short To Battery Voltage	• Signal voltage > 3.17 V	• Engine = running	• 40 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P13D5 Sensor For Internal Pressure Of Cylinder 3 Short Circuit To Ground	Cylinder 3 Pressure Sensor Circuit Short To Ground	• Signal voltage < 0.13 V	• Engine = running	• 40 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P13D6 Sensor For Internal Pressure Of Cylinder 3 Implau-	Cylinder 3 Pressure Sensor Circuit Out Of Range	• Signal voltage < 0.33 V and/or > 3.09 V	• Engine = running	• 1,000 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
	Cylinder 3 Constant Pressure	• Deviation between maximum and minimum cylinder pressure sensor 1 < 20.0 bar	• Engine condition = running • Throttle valve = open • Barometric > 750.0 hPa			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
sible Signal	Cylinder 3 Pressure Sensor Offset	• Offset out of range < -7.0 bar and/or > 7.0 bar				
	Cylinder 3 Plausibility With Calculated Pressure	• Difference between calculated cylinder pressure, based on intake air pressure and compression ratio, and measured cylinder pressure sensor #1 out of range < -10.0 bar and/or > 10.0 bar	• Engine condition = fuel cut off • Throttle valve = open • LP EGR valve = closed • HP EGR valve = closed • IAT = > -2° C and/or < 44° C • ECT = > 60° C and/or < 100° C	• 40 revolutions		
P13D7 Sensor For Internal Pressure Of Cylinder 4 Electrical Error	Cylinder 4 Pressure Sensor Circuit Open Or Short To Battery Voltage	• Signal voltage > 3.17 V	• Engine = running	• 40 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P13D8 Sensor For Internal Pressure Of Cylinder 4 Short Circuit To Ground	Cylinder 4 Pressure Sensor Circuit Short To Ground	• Signal voltage < 0.13 V	• Engine = running	• 40 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P13D9 Sensor For Internal Pressure	Cylinder 4 Pressure Sensor Circuit Out Of Range	• Signal voltage < 0.33 V and/or > 3.09 V	• Engine = running	• 1,000 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
Of Cylinder 4 Implausible Signal	Cylinder 4 Constant Pressure	• Deviation between maximum and minimum cylinder pressure sensor 1 < 20.0 bar	• Engine condition = running • Throttle valve = open • Barometric > 750.0 hPa			Module J179 and Glow Plug, Checking", page 205 .
	Cylinder 4 Pressure Sensor Offset	• Offset out of range < -7.0 bar and/or > 7.0 bar				
	Cylinder 4 Plausibility With Calculated Pressure	• Difference between calculated cylinder pressure, based on intake air pressure and compression ratio, and measured cylinder pressure sensor #1 out of range < -10.0 bar and/or > 10.0 bar	• Engine condition = fuel cut off • Throttle valve = open • LP EGR valve = closed • HP EGR valve = closed • IAT = > -2° C and/or < 44° C • ECT = > 60° C and/or < 100° C	• 40 revolutions		
P13E0 Sensor For Internal Pressure Of Cylinder 1 Malfunction	Cylinder 1 Pressure Sensor Circuit Plausibility Check	• Pressure based measured TDC position sensor #1 out of range < -1.8 CA and/or > 1.8 CA	• Engine condition = fuel cut off • ECT > 69.96° C	• 40 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ "3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking", page 205 .
P13E1 Sensor For Internal Pressure Of Cylinder 2 Malfunction	Cylinder 2 Pressure Sensor Circuit Plausibility Check	• Pressure based measured TDC position sensor #1 out of range < -1.8 CA and/or > 1.8 CA	• Engine condition = fuel cut off • ECT > 69.96° C	• 40 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ "3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking", page 205 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P13E2 Sensor For Internal Pressure Of Cylinder 3 Malfunction	Cylinder 3 Pressure Sensor Circuit Plausibility Check	• Pressure based measured TDC position sensor #1 out of range < -1.8 CA and/or > 1.8 CA	• Engine condition = fuel cut off • ECT > 69.96° C	• 40 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P13E3 Sensor For Internal Pressure Of Cylinder 4 Malfunction	Cylinder 4 Pressure Sensor Circuit Plausibility Check	• Pressure based measured TDC position sensor #1 out of range < -1.8 CA and/or > 1.8 CA	• Engine condition = fuel cut off • ECT > 69.96° C	• 40 revolutions	• 2 DCY	– Check the Automatic Glow Time Control Module - J179- . Refer to ⇒ “3.6.2 Automatic Glow Time Control Module J179 and Glow Plug, Checking”, page 205 .
P140C EGR Sensor 2 Bank 1 Signal Too Low	Low Pressure EGR Sensor Position Circuit High	• Position sensor signal < 4,850.0 mV	• P0651	• 480.0 ms	• 2 DCY	– Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .
P140E EGR Sensor 2 Bank 1 Signal Too High	Low Pressure EGR Sensor Position Circuit Low	• Position sensor signal < 150.0 mV		• 480.0 ms	• 2 DCY	– Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P169A Loading Mode Active	Transport Mode Active	• Transport mode active	• Production mode not active and vehicle mileage below 100 miles • And • Vehicle speed < 5 mph • Engine speed = 0 rpm • Max. driving distance since initial vehicle start-up < 200 miles	• Fault is stored in fault memory during ECU shut down	• 1 DCY	– Vehicle is in Transport Mode (Loading Mode). It can be turned off with a scan tool or will automatically switch off after approximately 100 km (62.15 miles) have accumulated on the vehicle. May need to perform readiness check. Refer to ⇒ “3.2 Readiness Code”, page 17 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2000 NOx Absorber Efficiency Below Threshold Bank 1	NOx Absorber Efficiency Below Threshold	• Oxygen signals post NOx trap < 0.95 • Oxygen signals pre NOx trap < 0.045 • Mass of reductant consumption < 0.9 g	• Regeneration demand for NOx trap = on • Adaptation of oxygen sensor pre and post NOx trap = realized • Engine speed 1,000 – 2,750 RPM • Upstream turbine temperature 50 – 850° C • Temperature of upstream NOx trap 220 – 550° C • ECT 40 – 105° C • Fuel temp < 90° C • APP > 1.0% and < 100.0% • Engine run time > 240.0 s • Baro > 750.0 hPa	• 10.0 s	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 . Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 261 . – Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2002 Particulate Filter Efficiency Below Threshold Bank 1	Particulate Trap Efficiency Below Threshold	• Differential pressure signal < (exhaust gas volume flow) • Or • Accumulated loading increment from differential pressure < 1.0 g	• Time since engine start 90.0 s • exhaust temperature downstream EGR - cooler > 60° C or < 200° C • HP - EGR valve < 30.0% open • LP - EGR mass flow > 17 kg/h • LP - EGR valve > 55.0% open for > 2.5 s • Temperature downstream DPF < 400° C or > 140° C • DPF regeneration = not active • Above conditions must be fulfilled accumulative for 40.0 s to get a monitor result	• 6.0 s	• 2 DCY	– Regeneration Service must be performed. Refer to appropriate repair manual. – Check the Exhaust Pressure Sensor 1 - G450- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 . – Check the Differential Pressure Sensor - G505- . Refer to ⇒ “3.6.7 Differential Pressure Sensor G505 , Checking”, page 218 . – The diesel particulate filter may need to be replaced. Refer to appropriate repair manual.
		• Differential pressure signal < f (exhaust gas volume flow)	• Modeled particulate matter trap surface temp. > 199.96 and < 499.96° C • Exhaust gas volume flow > 160.0 and < 600.0 mΔ 3/h • ECT > f (ambient temperature) • Time since engine start > 300.0 s			

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Ratio of filtered temperature dynamic upstream and downstream of the PM trap < 1.2 [-]	• Exhaust gas temp. before and after PM trap > 29.96° C • Time since PM trap regeneration > 2.0 s • ECT > -15° C • Time since engine start > 10.0 s	• Acceleration or deceleration time at most 200.0 s (data gathering frozen if continuous acceleration or deceleration lasts more than 35.0 s)		
P2004 Intake Manifold Runner Control Stuck Open Bank 1	Intake Manifold Runner Flap Stuck Open	• Intake manifold runner stuck (open) > 12.0%	• Control deviation detected > 10.0% or < -10.0%	• 14.0 s	• 2 DCY	– Check the Intake Flap Control Unit - GX14- . Refer to ⇒ “3.6.24 Intake Flap Control Unit GX14 , Checking”, page 252 .
P2006 Intake Manifold Runner Control Stuck Closed Bank 1	Intake Manifold Runner Flap Stuck Closed	• Intake manifold runner stuck (closed) < 12.0%	• Control deviation detected > 10.0% or < -10.0%	• 14.0 s	• 2 DCY	– Check the Intake Flap Control Unit - GX14- . Refer to ⇒ “3.6.24 Intake Flap Control Unit GX14 , Checking”, page 252 .
P2008 Intake Manifold Runner Control Circuit/ Open Bank 1	Intake Manifold Runner Motor Circuit Open	• Signal voltage > 0.8 or < 2.0 V	• ECM power stage = off	• 0.6 s • Continuous	• 2 DCY	– Check the Intake Flap Control Unit - GX14- . Refer to ⇒ “3.6.24 Intake Flap Control Unit GX14 , Checking”, page 252 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2009 Intake Manifold Runner Control Circuit Low Bank 1	Intake Manifold Runner Motor Circuit Short To Ground	• Signal current > 8.0 – 18.0 A	• ECM power stage = on	• 0.5 s	• 2 DCY	– Check the Intake Flap Control Unit - GX14- . Refer to ⇒ “3.6.24 Intake Flap Control Unit GX14 , Checking”, page 252 .
P2010 Intake Manifold Runner Control Circuit High Bank 1	Intake Manifold Runner Motor Circuit Short To Battery Voltage	• Signal current > 8.0 – 18.0 A	• ECM power stage = on	• 0.5 s	• 2 DCY	– Check the Intake Flap Control Unit - GX14- . Refer to ⇒ “3.6.24 Intake Flap Control Unit GX14 , Checking”, page 252 .
P2015 Intake Manifold Runner Position Sensor/Switch Circuit Range/Performance Bank 1	Intake Manifold Runner Position Sensor Circuit Physical Signal Range Check High	• Signal voltage > 4.61 V		• 0.5 s	• 2 DCY	– Check the Intake Flap Control Unit - GX14- . Refer to ⇒ “3.6.24 Intake Flap Control Unit GX14 , Checking”, page 252 .
	Intake Manifold Runner Position Sensor Circuit Physical Signal Range Check Low	• Signal voltage < 0.39 V				
P2016 Intake Manifold Runner Position Sensor/Switch Circuit Low Bank 1	Intake Manifold Runner Position Sensor Circuit Short To Ground	• Signal voltage < 0.25 V		• 0.5 s	• 2 DCY	– Check the Intake Flap Control Unit - GX14- . Refer to ⇒ “3.6.24 Intake Flap Control Unit GX14 , Checking”, page 252 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2017 Intake Manifold Runner Position Sensor/ Switch Circuit High Bank 1	Intake Manifold Runner Position Sensor Circuit Short To Battery Voltage	• Signal voltage > 4.75 V		• 0.5 s	• 2 DCY	– Check the Intake Flap Control Unit - GX14- . Refer to ⇒ “3.6.24 Intake Flap Control Unit GX14 , Checking”, page 252 .
P2031 Exhaust Gas Temperature Sensor Circuit Bank 1 Sensor 2	Exhaust Gas Temperature Sensor 3 Circuit Open Or Short To Battery Voltage	• Signal voltage > 1.72 V	• Engine running	• 480.0 ms	• 2 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .
P2032 Exhaust Gas Temperature Sensor Circuit Low Bank 1 Sensor 2	Exhaust Gas Temperature Sensor 3 Circuit Short To Ground	• Signal voltage < 0.45 V	• Engine running	• 480.0 ms	• 2 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2080 Exhaust Gas Temperature Sensor Circuit Range/ Performance Bank 1 Sensor 1	Exhaust Gas Temperature Sensor 1 Circuit Plausibility Check	• Sensor temperature < 85° C	• Engine run time > 3.0 min • ECT > 10° C • Simulated sensor temp > 300° C	• 10.0 s	• 2 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .
P2084 Exhaust Gas Temperature Sensor Circuit Range/ Performance Bank 1 Sensor 2	Exhaust Gas Temperature Sensor 2 Circuit Plausibility Check	• Sensor temperature < 85° C	• Engine run time > 3.0 min • ECT > 10° C • Simulated sensor temp > 250° C	• 10.0 s	• 2 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P20D8 Exhaust After Treatment Fuel Supply Control Performance	Exhaust After Treatment Fuel Supply Control Performance	• Control deviation < limit from Map for > limit from Map f (engine speed, torque)	• Regeneration demand for NOx trap = On • Adaptation of oxygen sensor pre and post NOx trap = realized • Engine speed 1,100 – 2,800 RPM • Upstream turbine temperature > 50 – 850° C • Temperature of upstream NOx trap > 220 – < 410° C • ECT 40 – 105° C • Vehicle speed > 34 kph • Fuel temp < 70° C • Atmospheric press > 750.0 hPa • APP > 1.0% and < 100.0% • Engine run time > 240.0 s	• 5.0 s	• 2 DCY	– Regeneration Service must be performed. Refer to appropriate repair manual. – Check the Catalytic Converter . Refer to ⇒ “3.6.31 Three Way Catalytic Converter (TWC), Checking”, page 269 . – The diesel particulate filter may need to be replaced. Refer to appropriate repair manual.
P2100 Throttle Actuator "A" Control Motor Circuit/ Open	Throttle Valve Actuator Control Motor Circuit Open	• Signal Voltage < 4.7 V	• ECM power stage = off	• 480.0 ms	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2101 Throttle Actuator "A" Control Motor Circuit Range/ Performance	Throttle Valve Actuator Control Motor Circuit Internal Electrical Error	• Signal current > 3.0 A	• ECM power stage = active	• 480.0 ms	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .
P2102 Throttle Actuator "A" Control Motor Circuit Low	Throttle Valve Actuator Control Motor Circuit Short To Ground	• Signal voltage < 2.97 V	• ECM power stage = off	• 480.0 ms	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .
P2103 Throttle Actuator "A" Control Motor Circuit High	Throttle Valve Actuator Control Motor Circuit Short To Battery Voltage	• Signal current > 3.0 A	• ECM power stage = active	• 480.0 ms	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .
P2111 Throttle Actuator "A" Control System - Stuck Open	Throttle Actuator Control System Stuck Open	• Valve stuck open > 12.0%	• Control deviation > 10.0% and/or < -10.0%	• 3.0 s	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2112 Throttle Actuator "A" Control System - Stuck Closed	Throttle Actuator Control System Stuck Closed	• Valve stuck closed < 12.0%	• Control deviation > 10.0% and/or < -10.0%	• 3.0 s	• 2 DCY	– Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .
P2122 Throttle/ Pedal Position Sensor/ Switch "D" Circuit Low	Throttle/ Pedal Position Sensor/ Switch "D" Circuit Low	• Signal voltage < 0.61 V		• 200.0 ms	• 2 DCY	– Check the Accelerator Pedal Module - GX2- . Refer to ⇒ “3.6.1 Accelerator Pedal Module GX2 , Checking”, page 203 .
P2123 Throttle/ Pedal Position Sensor/ Switch "D" Circuit High	Throttle/ Pedal Position Sensor/ Switch "D" Circuit High	• Signal voltage > 4.79 V		• 200.0 ms	• 2 DCY	– Check the Accelerator Pedal Module - GX2- . Refer to ⇒ “3.6.1 Accelerator Pedal Module GX2 , Checking”, page 203 .
P2127 Throttle/ Pedal Position Sensor/ Switch "E" Circuit Low	Throttle/ Pedal Position Sensor/ Switch "E" Circuit Low	• Signal voltage > 0.27 V		• 200.0 ms	• 2 DCY	– Check the Accelerator Pedal Module - GX2- . Refer to ⇒ “3.6.1 Accelerator Pedal Module GX2 , Checking”, page 203 .
P2128 Throttle/ Pedal Position Sensor/ Switch "E" Circuit High	Throttle/ Pedal Position Sensor/ Switch "E" Circuit High	• Signal voltage > 2.43 V		• 200.0 ms	• 2 DCY	– Check the Accelerator Pedal Module - GX2- . Refer to ⇒ “3.6.1 Accelerator Pedal Module GX2 , Checking”, page 203 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2138 Throttle/ Pedal Position Sensor/ Switch "D"/"E" Voltage Correlation	Throttle/ Pedal Position Sensor/ Switch "D"/"E" Voltage Correlation	• Difference between app sensor 1 voltage and app sensor 2 voltage) V (tolerance 13.0% – 20.0%)		• 260.0 ms	• 2 DCY	– Check the Accelerator Pedal Module - GX2- . Refer to ⇒ “3.6.1 Accelerator Pedal Module GX2 , Checking”, page 203 .
P2146 Fuel Injector Group "A" Supply Voltage Circuit/ Open	Fuel Injector Group "A" Supply Voltage Circuit Shorted Internally	• Diagnostic signal in power stage = failed	• Injector valve = switched on	• 4 [injections] • Continuous	• 2 DCY	– Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .
P2149 Fuel Injector Group "B" Supply Voltage Circuit/ Open	Fuel Injector Group "B" Supply Voltage Circuit Shorted Internally	• Diagnostic signal in power stage = failed	• Injector valve = switched 0n	• 4 [injections] • Continuous	• 2 DCY	– Check the Fuel Injectors . Refer to ⇒ “3.6.18 Fuel Injectors , Checking”, page 240 .
P2183 Engine Coolant Temperature Sensor 2 Circuit Range/ Performance	Engine Coolant Temperature Sensor On Radiator Circuit Range / Performance	• Temperature difference to at least 3 other temperature sensors at startup > 30 K	• Engine off time > 9.0 hr • IAT change after engine start < 5 K • ECT sensor 1 or 2 < 30° C • Decrease of coolant temperature 1 or 2 after engine start < 5 K	• 60.0 s, including 20.0 s continuous driving with velocity exceeding 25 mph • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor On Radiator Outlet - G83- . Refer to ⇒ “3.6.12 Engine Coolant Temperature Sensor On Radiator Outlet G83 , Checking”, page 228 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2184 Engine Coolant Temperature Sensor 2 Circuit Low	Engine Coolant Temperature Sensor On Radiator Outlet Circuit Short To Ground	• Signal voltage < 0.15 V		• 480.0 ms • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor On Radiator Outlet - G83- . Refer to ⇒ “3.6.12 Engine Coolant Temperature Sensor On Radiator Outlet G83 , Checking”, page 228 .
P2185 Engine Coolant Temperature Sensor 2 Circuit High	Engine Coolant Temperature Sensor On Radiator Outlet Circuit Open Or Short To Battery Voltage	• Signal Voltage > 3.25 V		• 480.0 ms • Continuous	• 2 DCY	– Check the Engine Coolant Temperature Sensor On Radiator Outlet - G83- . Refer to ⇒ “3.6.12 Engine Coolant Temperature Sensor On Radiator Outlet G83 , Checking”, page 228 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2195 O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 1	O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 1	• Deviation to oxygen concentration (while fuel cutoff) > 4.6% vol / vol	• Engine in fuel cutoff • EGR high and low pressure, closed • O2 heater temperature > 720 and/or < 840° C • Integrated air flow while in fuel cut-off > 85.0 g • Regeneration inactive • Engine speed > 1,200 RPM • Air mass 250.0 – 3,000.0 mg/ stroke	• 2.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 . – Check the Fuel Delivery Unit - GX1- / Fuel Pump Relay - J17- . Refer to ⇒ “3.6.17 Fuel Delivery Unit GX1 / Fuel Pump Relay J17 , Checking”, page 238 . – Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2196 O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 1	O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 1	• Deviation to oxygen concentration (while fuel cutoff) < -6.3% vol / vol	• Engine in fuel cutoff • EGR high and low pressure, closed • O2 heater temperature > 720 and/or < 840° C • Integrated air flow while in fuel cut-off > 85.0 g • Regeneration inactive • Engine speed > 1,200 RPM • Air mass 250.0 – 3,000.0 mg/ stroke	• 2.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 . – Check the Fuel Delivery Unit - GX1- / Fuel Pump Relay - J17- . Refer to ⇒ “3.6.17 Fuel Delivery Unit GX1 / Fuel Pump Relay J17 , Checking”, page 238 . – Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 .
P2237 O2 Sensor Positive Current Control Circuit/Open Bank 1 Sensor 1	O2 Sensor Positive Current Control Circuit/Open Bank 1 Sensor 1	• Pump current (IP) < 0.005 [-]	• Calculated oxygen concentration > 0.07 [-] • Fuel cutoff = not active • Battery voltage > 10.7 V	• 5.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2243 O2 Sensor Reference Voltage Circuit/ Open Bank 1 Sensor 1	O2 Sensor Reference Voltage Circuit/ Open Bank 1 Sensor 1	• Nernst voltage (UN) internal resistance > 1,104.0 Ω • Internal signal voltage > 3.0 V	• HO2 sensor heater temperature > 720° C • Battery voltage = exhaust gas flow, exhaust gas temperature at sensor element	• 4.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 .
P2251 O2 Sensor Negative Current Control Circuit/ Open Bank 1 Sensor 1	O2 Sensor Negative Current Control Circuit/Open Bank 1 Sensor 1	• Virtual ground (VM) internal resistance > 1,104.0 Ω • Internal signal voltage < 1.4 V and/or > 1.6 V	• HO2 sensor heater temperature > 720° C • Battery voltage = exhaust gas flow, exhaust gas temperature at sensor element	• 4.0 s • Continuous	• 2 DCY	– Check the Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2270 O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 2	O2 Sensor Signal Biased/ Stuck Lean Bank 1 Sensor 2	• Deviation to oxygen concentration during fuel cutoff > 4.6% vol / vol	• Fuel cutoff = active • Low and high pressure EGR closed • Heater control = active • Modeled dew point = exceeded • O2 Heater temp > 720 and/or < 840° C • Regeneration = inactive • Calculated oxygen concentration = stationary (for 1.5 s within 2.0% O2 range) • Current air mass > 100.0 mg/stroke • Integrated air flow while in fuel cutoff > 70.0 g • Engine speed > 1,200 RPM • Battery voltage > 10.7 V	• 2.0 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 261 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2271 O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 2	O2 Sensor Signal Biased/ Stuck Rich Bank 1 Sensor 2	• Deviation to oxygen concentration during fuel cutoff < -6.3%	• Fuel cutoff = active • Low and high pressure EGR closed • Heater control = active • Modeled dew point = exceeded • O2 heater temp > 720 and/or < 840° C • Regeneration = inactive • Calculated oxygen concentration = stationary (for 1.5 s within 2.0% O2 range) • Current air mass > 100.0 mg/stroke • Integrated air flow while in fuel cutoff > 70.0g • Engine speed > 1,200 RPM • Battery voltage > 10.7 V	• 2.0 s	• 2 DCY	– Check the Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to ⇒ “3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 261 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2279 MAP/MAF - Throttle Position Correlation	Intake Air System Leak	• Deviation between actual airflow and modeled mass air flow < 0.7	• Exhaust throttle valve > 89.5 and < 100.5% • Throttle valve < 100.5% > 99% • Intake flap < 101.0% > -1.0% • Engine speed 1,200 – 3,500 RPM • ECT between 69.95 and 106.95° C • Fuel quantity > 30.0 mg/hub	• 3.0 s	• 2 DCY	– Check for air leaks between the MAF and the throttle body, oil fill cap not tight or oil dipstick not seated in tube. Also check for any engine gaskets that can cause additional air to enter the crankcase can set this fault as the PCV system is not metered. If a vacuum leak or crankcase seal is the cause, the idle may be rough or unstable. – Check the Intake Manifold Sensor - GX9- . Refer to ⇒ “3.6.25 Intake Manifold Sensor GX9 , Checking”, page 255 . – Check the Throttle Valve Control Module - GX3- . Refer to ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2294 Fuel Pressure Regulator "A" Control Circuit/ Open	Fuel Pressure Regulator "B" Control Circuit Open	• Signal current < 0.8 mA	• Time after engine start 5.0 – 15.0 s	• 50.0 – 290.0 ms • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ “3.6.20 Fuel Pressure Regulator Valve N276 , Checking”, page 244 . – Check the Fuel Metering Valve - N290- . Refer to ⇒ “3.6.19 Fuel Metering Valve N290 , Checking”, page 242 .
P2295 Fuel Pressure Regulator "A" Control Circuit Low	Fuel Pressure Regulator "B" Control Circuit Low	• Signal voltage < 2.0 V	• Time after engine start 5.0 – 15.0 s	• 50.0 – 290.0 ms • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ “3.6.20 Fuel Pressure Regulator Valve N276 , Checking”, page 244 . – Check the Fuel Metering Valve - N290- . Refer to ⇒ “3.6.19 Fuel Metering Valve N290 , Checking”, page 242 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2296 Fuel Pressure Regulator "A" Control Circuit High	Fuel Pressure Regulator "B" Control Circuit High	• Signal current > 3.0 A	• Time after engine start 5.0 – 15.0 s	• 0.2 s • Continuous	• 2 DCY	– Check the Fuel Pressure Regulator Valve - N276- . Refer to ⇒ “3.6.20 Fuel Pressure Regulator Valve N276 , Checking”, page 244 . – Check the Fuel Metering Valve - N290- . Refer to ⇒ “3.6.19 Fuel Metering Valve N290 , Checking”, page 242 .
P240F EGR Slow Response	EGR System Dynamic Check	• Calculated characteristics value: Positive gradient of target air mass flow > 20.0 [-]	• EGR valve > 30.0% and/or < 89.0% • Fuel quantity > 5.0 mg • Engine speed 1,300 – 2,500 RPM • ECT > 20° C • Ambient temp > -10° C • Exhaust flap motor > 20.0% and/or < 89.0% • LP EGR valve > 20.0% and/or < 89.0% • Desired air mass charge > 40.0 mg/stroke and < 600.0 mg/stroke	• 10.0 s	• 2 DCY	– Check the EGR Valve 1 - GX5- . Refer to ⇒ “3.6.9 EGR Valve 1 GX5 , Checking”, page 222 . – Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Calculated characteristics value: Negative gradient of target air mass flow > 20.0 [-]	• EGR valve > 30.0% and/or < 89.0% • Fuel quantity > 5.0 mg • Engine speed 1,300 – 2,500 RPM • ECT > 20° C • Ambient temp > -10° C • Exhaust flap motor > 20.0% and/or < 89.0% • LP EGR valve > 20.0% and/or < 89.0% • Desired air mass charge < -40.0 mg/stroke and/or > -600.0 mg/stroke			
P2413 EGR System Performance	EGR System / Fuel Mean Value Adaption	• Number of learning points at fuel mass adaptation limit >= 4 • At upper limit = 6.0 mg/stroke • At lower limit = -6.0 mg/stroke		• 480.0 ms • Once / DCY	• 2 DCY	– Check the EGR Valve 1 - GX5- . Refer to ⇒ “3.6.9 EGR Valve 1 GX5 , Checking”, page 222 . – Check the EGR Valve 2 - GX6- . Refer to ⇒ “3.6.10 EGR Valve 2 GX6 , Checking”, page 224 .
P242A Exhaust Gas Temperature Sensor Circuit Bank 1 Sensor 3	Exhaust Gas Temperature Sensor 3 Circuit Open Or Short To Battery Voltage	• Signal voltage > 1.72 V		• 480.0 ms	• 2 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P242B Exhaust Gas Temperature Sensor Circuit Range/ Performance Bank 1 Sensor 3	Exhaust Gas Temperature Sensor 3 Circuit Plausibility Check	• Comparison of upstream turbine exhaust gas temp vs modeled temperature < 45 K	• Engine run time > 3.0 min • ECT > 10° C • Simulated sensor temp > 300° C • Or • Engine off time > 32,400.0 s • Decrease of IAT after engine start < 5 K • Decrease of AAT after engine start < 5 K	• 20.0 s with speed above 25 mph	• 2 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .
P242C Exhaust Gas Temperature Sensor Circuit Low Bank 1 Sensor 3	Exhaust Gas Temperature Sensor 3 Circuit Short To Ground	• Signal voltage < 0.45 V		480.0 ms •	• 2 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .
P244C Exhaust Temperature Too Low For Particulate Filter Regeneration Bank 1	Exhaust Gas Temperature Sensors Circuit Feedback Check	• Time to activate control loop EGT Upstream turbine > 45.0 s	• Regeneration demand for PM trap = On • Temperature upstream turbine > 300° C • Desired post injection > 1.0 mg/stroke • Fuel quality > 10.0 and/or < 30.0 mg/stroke • Engine speed > 1,200 and/or < 2,850 RPM • ECT between 20.1 – 114.9° C • Vehicle speed > 5 MPH	• 45.0 s	• 1 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
		• Time to activate control loop EGT Upstream particulate matter trap > 60.0 s	• Regeneration demand for PM trap = On • Temperature upstream turbine > 300° C • Desired post injection > 5.0 mg/stroke • Fuel quality > 10.0 and/or < 44.9 mg/stroke • Engine speed > 1,200 and/or < 3,050 RPM • ECT between 20.1 – 114.9° C • Vehicle speed > 35 MPH	• 60.0 s		
P2452 Particulate Filter Pressure Sensor "A" Circuit	Exhaust Pressure Sensor Circuit Short To Battery Voltage	• Signal voltage > 4.9 V		• 480.0 ms	• 2 DCY	– Check the Exhaust Pressure Sensor 1 - G450- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 .
P2453 Particulate Filter Pressure Sensor "A" Circuit Range/ Performance	Exhaust Pressure Sensor Circuit Offset Detection During After Run	• Differential pressure signal > 200.0 hPa and/or < -150.0 hPa • Or • Differential pressure signal > 80.0 hPa and/or < -80.0 hPa • Offset corrected differential pressure signal > 10.0 hPa and < -10.0 hPa	• Engine condition = after-run • Time since engine stop > 5.0 s • ECT > 59.96° C • Offset adaption during driving cycle = successful	• 500.0 ms	• 2 DCY	– Check the Exhaust Pressure Sensor 1 - G450- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2454 Particulate Filter Pressure Sensor "A" Circuit Low	Exhaust Pressure Sensor Circuit Short To Ground	• Signal voltage < 0.2 V		• 480.0 ms	• 2 DCY	– Check the Exhaust Pressure Sensor 1 - G450- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 .
P2456 Particulate Filter Pressure Sensor "A" Circuit Intermittent/ Erratic	Exhaust Pressure Sensor Circuit Plausibility Check	• Inverse change of differential pressure per time > 10.0 hPa/s • Inverse change of differential pressure per time > -10.0 hPa/s	• Change of volume flow < -20 (m^3/h)/s • Change of volume flow > 20 (m^3/h)/s • Engine = running • Time since engine started = 20.0 s	• 9.5 s	• 2 DCY	– Check the Exhaust Pressure Sensor 1 - G450- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 .
P2457 EGR Cooler "A" Efficiency Below Threshold	Exhaust Gas Recirculation Cooling System Performance	• Sensor temperature above threshold ≥ 40 K	• ECT > 70° C • Exhaust gas temperature upstream LP EGR cooler > 300° C • Engine speed > 900 RPM • Mass flow low pressure EGR > 0.1kg/h..- < 200.0 kg/h • Engine run time > 2.0 min • Status exhaust gas treatment = inactive PM trap regeneration	• 45.0 s	• 2 DCY	– Check the EGR Valve 1 - GX5- . Refer to ⇒ “3.6.9 EGR Valve 1 GX5 , Checking”, page 222 . – Check the EGR Temperature Sensor - G98- . Refer to ⇒ “3.6.8 EGR Temperature Sensor G98 , Checking”, page 220 . – Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2458 Particulate Filter Regeneration Duration Bank 1	Diesel Particulate Filter Regeneration Duration	• Regeneration time > 90.0 min	• PM trap regeneration = active • PM trap regeneration has ended successfully = true	• 90.0 min	• 1 DCY	– Regeneration Service must be performed. Refer to appropriate repair manual. – Check the Exhaust Pressure Sensor 1 - G450- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 . – Check the Differential Pressure Sensor - G505- . Refer to ⇒ “3.6.7 Differential Pressure Sensor G505 , Checking”, page 218 . – The diesel particulate filter may need to be replaced. Refer to appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2459 Particulate Filter Regeneration Frequency Bank 1	Diesel Particulate Filter Regeneration Frequency	• PM trap loading > dynamically rising threshold f (simulated engine emissions)	• PM trap regeneration = not active • PM trap regeneration has occurred successful = true • PM trap regeneration = starting	• Approx. 70 miles	• 2 DCY	– Regeneration Service must be performed. Refer to appropriate repair manual. – Check the Exhaust Pressure Sensor 1 - G450- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 . – Check the Differential Pressure Sensor - G505- . Refer to ⇒ “3.6.7 Differential Pressure Sensor G505 , Checking”, page 218 . – The diesel particulate filter may need to be replaced. Refer to appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2463 Particulate Filter Restriction - Soot Accumulation Bank 1	Diesel Particulate Filter Soot Accumulation	• Calculated particulate matter trap loading > 40.0 g		• 200.0 ms	• 2 DCY	– Regeneration Service must be performed. Refer to appropriate repair manual. – Check the Exhaust Pressure Sensor 1 - G450- . Refer to ⇒ “3.6.16 Exhaust Pressure Sensor 1 G450 , Checking”, page 236 . – Check the Differential Pressure Sensor - G505- . Refer to ⇒ “3.6.7 Differential Pressure Sensor G505 , Checking”, page 218 . – The diesel particulate filter may need to be replaced. Refer to appropriate repair manual.
P246E Exhaust Gas Temperature Sensor Circuit Bank 1 Sensor 4	Exhaust Gas Temperature Sensor 4 Circuit Open Or Short To Battery Voltage	• Signal voltage > 1.72 V		• 480.0 ms	• 2 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P246F Exhaust Gas Temperature Sensor Circuit Range/ Performance Bank 1 Sensor 4	Exhaust Gas Temperature Sensor 4 Circuit Plausibility Check	• Sensor temperature < 230° C • Or • Temperature difference to other temp sensors during cold start < 45 K	• Engine run time > 3.0 min • ECT > 10° C • Simulated sensor temp > 300° C • Or • Engine off time > 9.0 hrs • Decrease of intake air temp after engine start < 5 K • Decrease of ambient air temp after engine start < 5 K	• 60.0 s	• 2 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .
P2470 Exhaust Gas Temperature Sensor Circuit Low Bank 1 Sensor 4	Exhaust Gas Temperature Sensor 4 Circuit Short To Ground	• Signal voltage < 0.45 V		• 480.0 ms	• 2 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2478 Exhaust Gas Temperature Out Of Range Bank 1 Sensor 1	Exhaust Gas Temperature Sensor 1 Circuit Out Of Range	• Control deviation > 40 K	• Regeneration from PM trap = On • Temperature of upstream particulate matter trap > 100 °C and < 410 °C • temperature downstream particulate matter trap < 295° C • Fuel quantity > 10 and/or < 45 mg/stroke • Engine speed > 1100 and/or < 3500 RPM • ECT > 25° C and/or < 70° C • torque > 50 Nm and/or < 300 Nm • Gear > 2 • Ambient temperature > -10 °C • Baro > 750 hPa	• 30.0 s	• 1 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .
P247A Exhaust Gas Temperature Out Of Range Bank 1 Sensor 3	Exhaust Gas Temperature Sensor 3 Circuit Out Of Range	• Control deviation > limit from map • Or • < Limit from Map f (engine speed, torque)	• Regeneration from PM trap = On • Upstream turbine temperature > 450° C • Desired post injection > 5.0 mg/stroke • Fuel quantity > 3.0 mg/stroke • Engine speed 1,250 – 4,000 RPM • ECT between 20 – 115° C • Veh speed > 35 km/h	• 30.0 s	• 1 DCY	– Check the Exhaust Gas Temperature Sensors . Refer to ⇒ “3.6.15 Exhaust Gas Temperature Sensors , Checking”, page 234 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2563 Turbocharger Boost Control Position Sensor "A" Circuit Range/ Performance	Charge Pressure Actuator Position Sensor Circuit Range / Performance	• Signal voltage > 4.5 V and/or < 0.3 V		• 480.0 ms	• 2 DCY	– Check the Charge Pressure Actuator Position Sensor - G581- . Refer to ⇒ "3.6.6 Charge Air Pressure Actuator Position Sensor G581 , Checking", page 216 .
	Charge Pressure Actuator Position Sensor Circuit Desired Range (Closed)	• Signal voltage > 1.72 V and/or < 0.3 V	• Engine = running • Desired position of Turbo charger actuator = 100.0% • Battery voltage > 10.7 V • Ambient pressure signal > 733.0 hPa • Time after Start > 40,000.0 ms	• 200.0 ms		
P2564 Turbocharger Boost Control Position Sensor "A" Circuit Low	Charge Pressure Actuator Position Sensor Circuit Short To Ground	• Signal voltage < 0.15 V		• 480.0 ms	• 2 DCY	– Check the Charge Pressure Actuator Position Sensor - G581- . Refer to ⇒ "3.6.6 Charge Air Pressure Actuator Position Sensor G581 , Checking", page 216 .
P2565 Turbocharger Boost Control Position Sensor "A" Circuit High	Charge Pressure Actuator Position Sensor Circuit Open Or Short To Battery Voltage	• Signal voltage > 4.85 V		• 480.0 ms	• 2 DCY	– Check the Charge Pressure Actuator Position Sensor - G581- . Refer to ⇒ "3.6.6 Charge Air Pressure Actuator Position Sensor G581 , Checking", page 216 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P2610 ECM/PCM Engine Off Timer Performance	ECM / PCM Internal Engine Off Timer Performance	• Quantity count over time threshold < 7.52 or > 8.48 s .	• Engine off • Power on reset	• 24.0 s. in key Off position	• 2 DCY	– Replace the Engine Control Module - J623- Refer to the Repair Manual for procedure.
P2632 Fuel Pump "B" Control Circuit / Open	Auxiliary In-line Fuel Pump Circuit Open	• Signal current < 0.8 mA	• Fuel pump commanded off	• 270.0 – 480.0 ms • Continuous	• 2 DCY	– Check the Fuel Pump Relay 2 - J49- / Fuel Pump 2 - V277- . Refer to ⇒ “3.6.22 Fuel Pump Relay 2 / Fuel Pump 2 , Checking”, page 248 .
P2633 Fuel Pump "B" Control Circuit Low	Auxiliary In-line Fuel Pump Circuit Short To Ground	• Signal voltage < 2.0 V	• Fuel pump commanded off	• 270.0 – 480.0 ms • Continuous	• 2 DCY	– Check the Fuel Pump Relay 2 - J49- / Fuel Pump 2 - V277- . Refer to ⇒ “3.6.22 Fuel Pump Relay 2 / Fuel Pump 2 , Checking”, page 248 .
P2634 Fuel Pump "B" Control Circuit High	Auxiliary In-line Fuel Pump Circuit Short To Battery Voltage	• Signal current > 1.0 A	• Fuel pump commanded on	• 270.0 – 480.0 ms • Continuous	• 2 DCY	– Check the Fuel Pump Relay 2 - J49- / Fuel Pump 2 - V277- . Refer to ⇒ “3.6.22 Fuel Pump Relay 2 / Fuel Pump 2 , Checking”, page 248 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
P268A Fuel Injector Calibration Not Learned/ Programmed	Fuel Injectors Calibration Not Learned / Programmed	• Accumulated global release time of zero fuel calibration but disabled by rail pressure deviation > 35.0 s		• ≤ 1 UDC Cycle • Continuous	• 2 DCY	– Replace the Engine Control Module - J623- . Refer to appropriate repair manual.
U0001 High Speed CAN Communication Bus	High Speed CAN Communication Bus	• CAN driver A status Bus Off.	• Engine running	• 200.0 ms	• 2 DCY	– Check the CAN Bus. Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 .
U0002 High Speed CAN Communication Bus Performance	High Speed CAN Communication Bus Performance	• CAN driver A status no communication	• Engine running	• 240.0 ms	• 2 DCY	– Check the CAN Bus. Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 .
U0029 Vehicle Communication Bus A Performance	Vehicle Communication Bus A Performance	• CAN driver B status no communication	• Engine running	• 440.0 ms	• 2 DCY	– Check the CAN Bus. Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0101 Lost Communication With TCM	Lost Communication With TCM	• Value from TCM = error state	• Engine running	• 440.0 ms	• 2 DCY	– Check the CAN-Bus terminal resistance between the Transmission Control Module to the Engine Control Module - J623- . Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 .
U0121 Lost Communication With Anti-Lock Brake System (ABS) Control Module "A"	Lost Communication With Anti-Lock Brake System (ABS) Control Module	• Message from ABS module = missing	• Engine running	• 440.0 ms	• 2 DCY	– Check the CAN Bus. Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 .
U0146 Lost Communication With Gateway "A"	Lost Communication With Gateway "A"	• Fault message from gateway module = true		• 240.0 ms	• 2 DCY	– Check the CAN Bus. Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 .
U0155 Lost Communication With Instrument Panel Cluster (IPC) Control Module	Lost Communication With Instrument Panel Cluster (IPC) Control Module	• Fault messages received from Instrument cluster	• Engine running	• 440.0 ms	• 2 DCY	– Check the CAN Bus. Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0302 Software Incompatibility With Transmission Control Module	Software Incompatibility With Transmission Control Module	• Fault message from automatic transmission module.	• Engine running	• 440.0 ms	• 2 DCY	– Check for software updates and TSB's. Reprogram as necessary. If none are found, replace the Transmission Control Module . Refer to appropriate repair manual.
U0402 Invalid Data Received From TCM	Invalid Data Received From Transmission Control Module	• Wrong TCM messages received.	• Engine running	• 440.0 ms	• 2 DCY	– Check for software updates and TSB's. Reprogram as necessary. If none are found, replace the Transmission Control Module . Refer to appropriate repair manual.
U0415 Invalid Data Received from Anti-Lock Brake System (ABS) Control Module "A"	Invalid Data Received From Anti-Lock Brake System Control Module	• Implausible ABS messages sent. Veh speed > 320 km/h or missing vehicle speed data.	• Engine running	• 500.0 ms	• 2 DCY	– Check the CAN Bus. Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 . – Check the vehicle speed signal. Refer to ⇒ “3.6.33 Vehicle Speed Signal, Checking”, page 272 .

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U0423 Invalid Data Received From Instrument Panel Cluster Control Module	Invalid Data Received From Instrument Panel Cluster Control Module	• Error message sent from instrument cluster to ECU = invalid data.	• Battery voltage > 9.0 V	• 440.0 ms	• 2 DCY	– Check for correct software version and VIN or update software for the IPC Module if available. If OK, replace the Instrument Cluster Control Module - J285- . Refer to appropriate repair manual.
U1024 Instrument Cluster Control Module Read Out DTC	Instrument Cluster Control Module Read Out DTC	• Error message sent from instrument cluster to ECU	• Communication time after T15 on > 1.0 s	• 2.0 s	• 2 DCY	– Check the CAN Bus. Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 . – Check IPC communication with a scan tool. If no IPC or intermittent communication with scan tool exists and all other modules communicate with tool, check IPC connectors and terminals for spread or loose connection. Check power and grounds. If above check results are OK, replace IPC Module. Refer to appropriate repair manual.

DTC / Description	Monitor Strategy Description	Malfunction Criteria and Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	MIL Illumination	Component Diagnostic Procedure
U102C ESP Read Out DTC	Lost Communication With Anti-Lock Brake System (ABS) Control Module	• No TCM messages received.	• Engine torque > 120.0 Nm	• 500.0 ms	• 2 DCY	– Check the CAN Bus. Refer to ⇒ “3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking”, page 214 .

3.5 Transmission DTC Tables

- ⇒ “3.5.1 Transmission Control Module , 6-spd 09G”, page 151
- ⇒ “3.5.2 Transmission Mechatronic , DSG 6-spd 02E”, page 167

3.5.1 Transmission Control Module , 6-spd 09G

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0604	Internal Control Module Random Access Memory (RAM) Error	• RAM area check	• Comparison of writing data and reading data	• Writing data is different from reading one		• 40.0 s	• 2 DCY
P0605	Internal Control Module Read Only Memory (ROM) Error	• ROM area check	• Comparison of stored checksum value and calculated checksum	• Two checksum values are not same		• 40.0 s	• 2 DCY
P0613	TCM Processor	• 2nd CPU detects miscalculation	• Check-calculation of 1st CPU failed	• Single reset does not cover problem		• XX s	• 2 DCY
P0614	ECM/TCM Incompatible	• CAN receive data check	• Detection of error signal	• Transmission coding is manual transmission code (0Fh) • Max torque is not same as one in ATCU	• CAN bus: ACTIVE • ECU communication: ACTIVE • ECU data update: ACTIVE	• 250.0 ms	• 2 DCY

AQ-250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0705	Transmission Range Sensor "A" Circuit (PRNDL Input)	• A, B, C and PA signal check in every shift lever position.	• Detection of wrong combination of the A, B, C and PA signal	• Wrong combination for more than 350.0 ms		• 350.0 ms	• 2 DCY
P0715	Input Turbine/ Speed Sensor "A" Circ	• Electrical check	• Detection of wrong input AD value	• Voltage < 0.2 volt (AD value < 45) for more than 100.0 ms • Or • (AD value > 545) voltage > 3.8 volt for more than 100.0 ms	• Input sensor: no failure decision for input sensor no pulse failure	• 100.0 ms • 5 times	• 2 DCY
P0716	Input/ Turbine Shaft Speed Sensor "A" Circuit Range/ Performance	• No pulse check	• Comparison pulse of input revolution and output revolution	• No pulse of input sensor more than 125.0 ms	• Engine speed > 400 RPM • Output sensor: ACTIVE • Output speed >= 300 RPM • Input sensor: no during failure detection or after failure decision for input sensor electrical failure	• 125.0 ms • 4 times	• 2 DCY
P0720	output Shaft Speed Sensor Circuit	• Electrical check	• Detection of wrong input AD value	• Voltage < 0.2 volt (AD value < 45) for more than 100.0 ms • Or • (AD value > 545) voltage > 3.8 volt for more than 100.0 ms	• output sensor: no failure decision for output sensor no pulse	• 100.0 ms • 5 times	• 2 DCY

AQ-250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0721	Output Shaft Speed Sensor Circuit Range/ Performance	• No pulse check	• Comparison pulse of input revolution and output revolution	• No pulse of output sensor more than 250.0s	• Engine speed: > 400 RPM • Input sensor: ACTIVE • Calculated output speed by input speed: >= 300 RPM • Main solenoid switch: ON • Gear condition: Engage • Range: D,S • Inhibitor switch: no fault • Output sensor: no during failure detection or after failure decision for output sensor electrical failure • Solenoid: no fault (except S2) • Linear solenoid: no fault	• 250.0 ms • 2 times	• 2 DCY
P0725	Engine Speed Input Circuit	• CAN receive data check	• Detection of error signal		• CAN bus: ACTIVE • ECU communication: ACTIVE • ECU data update: ACTIVE	• 250.0 ms	• 2 DCY

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0729	Gear 6 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• Comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1.0 s • 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1.0 s	• Engine speed > 400 RPM • Output revolutions > 250 RPM • Shift lever D or S • Brake: OFF • Slip difference of output speed (In case ABS valid) difference < 10.0 • Revolution sensor, no back up condition • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 166)	• 1.0 • 12 times	• 2 DCY • Cumulative

AQ-250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0731	Gear 1 Incorrect Ratio	• Input and output rpm signal check. Separate error memory for each gear.	• Comparison of indicated slip and actual slip with stored values	• ABS (input rev – output rev x other gear ratio) < (0.04 x other gear ratio x output rev) for more than 1.0 s	• Engine speed > 400 RPM • Output revolutions > 250 RPM • Estimated engine torque > 100 Nm at 1st gear > 80 Nm at 1st EB gear • Shift lever D or S • Brake: OFF • Slip difference of output speed and ABS difference < 10.0% (in case of ABS failure, this condition isn't activated) • Engaged gear, 1st gear • Revolution sensor, no back up condition • Model oil temperature >= 20° C • Common parameter, common condition (see footnote ⇒ page 166)	• 1.0 s • 12 times	• 2 DCY • Cumulative

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• Neutral condition check	• Detection of slip condition	• Input revolutions > output revolutions x 1st gear ratio + 400 RPM for more than 3.3 s	• Engine speed > 400 RPM • Shift lever D or S • Output revolutions <= 500 RPM • Output revolutions which <= 500 rpm calculated from ABS (In case of ABS failure, this condition isn't activated) • L-up condition: OFF • Input sensor, no back up condition • Output sensor, active or back up by ABS • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 166)	• 2 times	• 2 DCY • Cumulative but, in case of changing the shift lever position, counter = 0

AQ-250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0732	Gear 2 Incorrect Ratio	• Neutral condition check	• Detection of slip condition	• Input revolutions > output revolutions x 1st gear ratio + 400 RPM for more than 3.3 s	• Engine speed > 400 RPM • Shift lever D or S • Output revolutions <= 500 RPM • Output revolutions which <= 500 RPM calculated from ABS (In case of ABS failure, this condition isn't activated) • L-up condition: OFF • Input sensor, no back up condition • Output sensor, active or back up by ABS • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 166)	• 2 times	• 2 DCY • Cumulative but, in case of changing the shift lever position, counter = 0

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• Input and output RPM signal check. Separate error memory for each gear.	• Comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1.0 s • 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1.0 s	• Engine speed > 400 RPM • Output revolutions > 250 RPM • Shift lever D or S • Brake: OFF • Slip difference of output speed (In case ABS valid) difference < 10.0% • Revolution sensor, no back up condition • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 166)	• 1.0 s • 12 times	• 2 DCY • Cumulative

AQ-250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0733	Gear 3 Incorrect Ratio	• Input and output RPM signal check. Separate error memory for each gear.	• Comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1.0 s • 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1.0 s	• Engine speed > 400 RPM • Output revolutions > 250 RPM • Shift lever D or S • Brake: OFF • Slip difference of output speed (In case ABS valid) difference < 10.0% • Revolution sensor, no back up condition • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 166)	• 1.0 s • 12 times	• 2 DCY • Cumulative

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0734	Gear 4 Incorrect Ratio	• Input and output RPM signal check. Separate error memory for each gear.	• Comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1.0 s • 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1.0 s	• Engine speed > 400 RPM • Output revolutions > 250 RPM • Shift lever D or S • Brake: OFF • Slip difference of output speed (In case ABS valid) difference < 10.0% • Revolution sensor, no back up condition • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 166)	• 1.0 s • 12 times	• 2 DCY • Cumulative

AQ-250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0735	Gear 5 Incorrect Ratio	• Input and output RPM signal check. Separate error memory for each gear.	• Comparison of indicated slip and actual slip with stored values	• 1. ABS (input revolutions – output revolutions x other gear ratio) < (0.04 x other gear ratio x output revolutions) for more than 1.0 s • 2. slip differences > (0.20 x current gear ratio x output revolutions) for more than 1.0 s	• Engine speed > 400 RPM • Output revolutions > 250 RPM • Shift lever D or S • Brake: OFF • Slip difference of output speed (In case ABS valid) difference < 10.0% • Revolution sensor, no back up condition • Model oil temperature >= 0° C • Common parameter, common condition (see footnote ⇒ page 166)	• 1.0 s • 12 times	• 2 DCY • Cumulative
P0743	Torque Converter Clutch Circuit Electrical	• Input AD value check in every Linear solenoid.	• Detection of wrong input AD value	• Feedback current > 1,333.0 mA (AD value > 1,000.0) for more than 100.0 ms		• 100.0 ms • 5 times	• 2 DCY
				• Feedback current < 23.0 mA (AD value < 15) for more than 100.0 ms	• Main solenoid switch: ON		
		• Linear solenoid feedback current check	• Comparison of target current and feedback current	• Sum of difference of two current > 20,000.0 Ω	• Linear feedback current is > 23.0 mA (AD:15) < 1,333.0 mA (AD:1,000.0)	• 2 times	• 2 DCY • Continuously

AQ-250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0748	Pressure Control Solenoid "A" Electrical	• Input AD value check in every Linear solenoid.	• Detection of wrong input AD value	• Feedback current > 1,333.0 mA (AD value > 1,000.0) for more than 100.0 ms		• 100.0 ms • 5 times	• 2 DCY
				• Feedback current < 23.0 mA (AD value < 15) for more than 100.0 ms	• Main solenoid switch: ON		
		• Linear solenoid feedback current check	• Comparison of target current and feedback current	• Sum of difference of two current > 20,000.0 Ω	• Linear feedback current is > 23.0 mA (AD:15) < 1,333.0 mA (AD:1,000.0)	• 2 times	• 2 DCY • Continuously
P0753	Shift Solenoid "A" Electrical	• Conduction check in ON/OFF solenoid.	• Comparison of the signal of solenoid monitor and solenoid driver output	• Wrong output signal for more than 100.0 ms		• 100.0 ms • 5 times	• 2 DCY
P0798	Pressure Control Solenoid "C" Electrical	• Input AD value check in every Linear solenoid.	• Detection of wrong input AD value	• Feedback current > 1,333.0 mA (AD value > 1,000.0) for more than 100.0 ms		• 100.0 ms • 5 times	• 2 DCY
				• Feedback current < 23.0 mA (AD value < 15) for more than 100.0 ms	• Main solenoid switch: ON		
		• Linear solenoid feedback current check	• Comparison of target current and feedback current	• Sum of difference of two current > 20,000.0 Ω	• linear feedback current is > 23.0 mA (AD:15) < 1,333.0 mA (AD:1,000.0)	• 2 times	• 2 DCY • Continuously

AQ-250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0811	Excessive Clutch "A" Slippage	• OFF stuck check.	• Comparison of engine RPM and input RPM	• Engine RPM – input RPM > 100 RPM for 2.0 s	• Engine speed > 400 RPM • Shift lever D or S • Engine speed < 4,000 RPM • Estimated engine torque >= 0 Nm • Revolution sensor, no back up condition • SLU target current > 1,000.0 mA • Model oil temperature >= 20° C • Common parameter, common condition (see footnote ⇒ page 166)	• 2.0 s • 6 times	• 2 DCY • Continuously
P0864	TCM Communication Circuit Range/ Performance	• CAN communication check	• detection of communication error (all frames which are entered in ATCU)	• ECU no communication for more than 50 ms (In case of repeat rate is over 25 ms, double value of repeat rate is used)	• CAN bus: ACTIVE • time: 500 ms after ignition: ON	• 500.0 ms (In case of repeat rate is over 50.0 ms, 10 times value of repeat rate is used)	• 2 DCY

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• Detection of communication error (one frame which is entered in ATCU)	• ECU no communication for more than 50.0 ms (In case of repeat rate is over 25.0 ms, double value of repeat rate is used)	• CAN bus: ACTIVE • Time: 500.0 ms after ignition: ON • ECU communication: not in no communication failure	• 1,000.0 ms (In case of repeat rate is over 50.0 ms, 20 times value of repeat rate is used)	
		• CAN receive data check	• ECU signal data freeze (data counter (ID488, Byte8, Bit7 – 4) not updated)		• CAN bus: ACTIVE • CAN data repeat rate: the space of time between two received messages has not exceeded double the transmission cycle time	• No update in five message	
		• CAN communication check	• Detection of communication error	• No acknowledge condition for more than 300.0 ms	• CAN bus: ACTIVE • Time: 500.0 ms after ignition: ON	• 300.0 ms	
P0865	TCM Communication Circuit Low	• CAN communication check	• Detection of communication error	• CAN BUS off condition for more than 250.0 ms	• Time 500.0 ms after ignition: ON	• 250.0 ms	• 2 DCY
P2122	Throttle/ Pedal Position Sensor/ Switch "D" Circuit Low	• CAN communication check	• Detection of error signal		• CAN bus: ACTIVE • ECU communication: ACTIVE • ECU data update: ACTIVE	• 250.0 ms	• 2 DCY

AQ-250 09G							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P2637	Torque Management Feedback Signal "A"	• CAN receive data check for “signal invalid”	• detection of error signal (0xFF)		• CAN bus: ACTIVE • ECU communication: ACTIVE • ECU data update: ACTIVE	• 250.0 ms	• 2 DCY
P2716	Pressure Control Solenoid "D" Electrical	• Input AD value check in every Linear solenoid.	• Detection of wrong input AD value	• Feedback current > 1,333.0 mA (AD value > 1,000.0) for more than 100.0 ms		• 100.0 ms • 5 times	• 2 DCY
				• Feedback current < 23.0 mA (AD value < 15) for more than 100.0 ms	• Main solenoid switch: ON	• 100.0 ms • 5 times	• 2 DCY
		• Linear solenoid feedback current check	• Comparison of target current and feedback current	• Sum of difference of two current > 20,000.0 Ω	• Linear feedback current is > 23.0 mA (AD: 15) < 1,333.0 mA (AD: 1,000.0)	• 2 times	• 2 DCY • Continuously
P2725	Pressure Control Solenoid "E" Electrical	• Input AD value check in every Linear solenoid.	• Detection of wrong input AD value	• Feedback current > 1,333.0 mA (AD value > 1,000) for more than 100.0 ms		• 100.0 ms • 5 times	• 2 DCY
				• Feedback current < 23 mA (AD value < 15) for more than 100 ms	• Main solenoid switch: ON	• 100.0 ms • 5 times	• 2 DCY
		• Linear solenoid feedback current check	• Comparison of target current and feedback current	• Sum of difference of two current > 20,000.0 Ω	• Linear feedback current is > 23.0 mA (AD: 15) < 1,333.0 mA (AD: 1,000.0)	• 2 times	• 2 DCY • Continuously

AQ-250 09G							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P2734	Pressure Control Solenoid "F" Electrical	• Input AD value check in every Linear solenoid.	• Detection of wrong input AD value	• Feedback current > 1,333.0 mA (AD value > 1,000) for more than 100.0 ms		• 100.0 ms • 5 times	• 2 DCY
				• Feedback current < 23.0 mA (AD value < 15) for more than 100.0 ms	• Main solenoid switch: ON	• 100.0 ms • 5 times	• 2 DCY
		• Linear solenoid feedback current check	• Comparison of target current and feedback current	• Sum of difference of two current > 20,000.0 Ω	• Linear feedback current is > 23.0 mA (AD: 15) < 1,333.0 mA (AD: 1,000)	• 2 times	• 2 DCY • Continuously

Footnote:

- main solenoid switch ON
- gear condition engaged
- S1 solenoid No fault
- linear solenoid no fault
- inhibitor switch no fault
- CAN communication no fault
- ECU data update no fault
- estimated engine torque no fault
- engine speed no fault
- accelerator pedal no fault
- T/M coding and MDI max info no fault
- ROM no fault
- RAM no fault
- safety processor no fault

3.5.2 Transmission Mechatronic , DSG 6-spd 02E

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0219	Engine Overspeed Condition	• Signal range check	• Rotational speed of gearbox input shaft exceed a maximum value	• Rotational speed> 12,000 RPM	• Terminal 15 voltage > 4.0 V for more than 500.0 ms	• 500.0 ms	• 2 driving cycles
P0501	Vehicle Speed Sensor "A" Circuit Range/ Performance	• Plausibility check	• Calculate the speed of input shaft with the gear ratio of engaged gear on input shaft and the output shaft speed. compare the calculated speed with measured speed of input shaft	• Speed difference magnitude > 330 RPM (output speed = 500 RPM) – 100 RPM (output speed >= 2,000 RPM)	• Gear on input shaft engaged • No valid CAN output speed information • Output speed > 25 RPM Or speed of input shaft > 1,000 RPM • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• 300.0 ms	• 2 driving cycles
P0701	Transmission Control System Range/ Performance	• Ssignal range check	• Travel sensor voltage gearshift fork 1/3 out of plausibility range • Travel sensor voltage gearshift fork 2/4 out of plausibility range	• Voltage < 100.0 mV • Or • Voltage > 4,900.0 mV		• 300.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• Travel sensor voltage gearshift fork 5/N out of plausibility range				
			• Travel sensor voltage gearshift fork 6/R out of plausibility range				
P0702	Transmission Control System Electrical	• Plausibility check	• In spite of cut off Common High-side Switch 1 a measurable current. In spite of turned on Common High-side Switch 1 no current measurable.	• CHS1 cut off and CHS1 - Current > 40.0 mA CHS1 turned on and CHS1 - Current < 200.0 mA	• One-time after reset • Terminal 15 voltage < 18.0 V • No short-circuit current check failure of CHS1 • Common high-side switch 1 voltage > 9.2 V • Gearbox subsystem 1 active • Common high-side switches not deactivated by module 2	• 300.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• In spite of cut off Common High-side Switch 2 a measurable current. In spite of turned on Common High-side Switch 2 no current measurable.	• CHS2 cut off and CHS2 - Current > 40.0 mA CHS2 turned on and CHS2 - Current < 200.0 mA	• One-time after reset • Terminal 15 voltage < 18.0 V • No short-circuit current check failure of CHS 2 • Common high-side switch 2 voltage > 9.2V • Gearbox subsystem 2 active • Common high-side switches not deactivated by module 2		
			• In spite of cut off Common High-side Switch 3 a measurable current. In spite of turned on Common High-side Switch 3 no current measurable.	• CHS3 cut off and CHS3 - Current > 40.0 mA CHS3 turned on and CHS3 - Current < 200.0 mA	• One-time after reset • Terminal 15 voltage < 18.0 V • No short-circuit current check failure of CHS3 and main pressure solenoid valve • Common high-side switch 1 and 2 voltage > 9.2 V • Common high-side switches not deactivated by module 2		

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0717	Input/ Turbine Shaft Speed Sensor "A" Circuit No Signal	• Plausibility check	• Calculate the speed of input shaft 1 with the gear ratio of engaged gear on input shaft 1 and the output shaft speed. compare the calculated speed with measured speed of input shaft 1	• Speed difference magnitude > 330 RPM (output speed = 500 RPM) – 100 RPM (output speed >= 2,000 RPM)	• Gear engaged on input shaft 1 • Valid CAN output speed information • Speed of input shaft 1 < 25 RPM • Output speed > 25 RPM • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• 900.0 ms	• 2 driving cycles
			• Calculate the speed of input shaft 2 with the gear ratio of engaged gear on input shaft 2 and the output shaft speed. compare the calculated speed with measured speed of input shaft 2		• Gear engaged on input shaft 2 • Valid CAN output speed information • Speed of input shaft 2 < 25 RPM • Output speed > 25 RPM • Terminal 15 voltage > 4.0 V for more than 500 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms		

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0729	Gear 6 Incorrect Ratio	• Synchronizing detection while the gearshift fork was controlled to engage sixth gear	• Integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2	• Integral > 125	• No slipping point adaptation of clutch 2 • Multiplexer position = 0 [-] • Control gearshift fork valve 3 >= 5.0% • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPMr more than 500.0 ms	• Synchronizing slip, duty factor of safety valve 2	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0731	Gear 1 Incorrect Ratio	• Synchronizing detection while the gearshift fork was controlled to engage first gear	• Integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1	• Integral > 125	• No slipping point adaptation of clutch 1 • Multiplexer position = 0 [-] • Control gearshift fork valve 1 >= 5.0% • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• Synchronizing slip, duty factor of safety valve 1	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0732	Gear 2 Incorrect Ratio	• Synchronizing detection while the gearshift fork was controlled to engage second gear	• Integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2	• Integral > 125	• No slipping point adaptation of clutch 2 • Multiplexer position = 1 • Control gearshift fork valve 3 >= 5.0% • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• Synchronizing slip, duty factor of safety valve 2	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0733	Gear 3 Incorrect Ratio	• Synchronizing detection while the gearshift fork was controlled to engage third gear	• Integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1	• Integral > 125	• No slipping point adaptation of clutch 1 • Multiplexer position = 0 [-] • Control gearshift fork valve 2 >= 5.0% • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• Synchronizing slip, duty factor of safety valve 1	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0734	Gear 4 Incorrect Ratio	• Synchronizing detection while the gearshift fork was controlled to engage fourth gear	• Integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2	• Integral > 125	• No slipping point adaptation of clutch 2 • Multiplexer position = 1 • Control gearshift fork valve 4 >= 5.0% • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• Synchronizing slip, duty factor of safety valve 2	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0735	Gear 5 Incorrect Ratio	• Synchronizing detection while the gearshift fork was controlled to engage fifth gear	• Integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 1	• Integral > 125	• No slipping point adaptation of clutch 1 • Multiplexer position = 1 [-] • Control gearshift fork valve 1 >= 5.0% • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 rpm for more than 500.0 ms	• Synchronizing slip, duty factor of safety valve 1	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0736	Reverse Incorrect Ratio	• Unable to disengage the reverse gear	• Gearshift fork of reverse gear stays in shifted position in spite of control to disengage	• Gearshift fork position < synchronizing point reverse gear - 10.0% synchronizing point measured by a basic adjustment (reverse gear stays in shifted position) control gearshift fork	• Control safety valve 2 (ON) >= 20.0% • Multiplexer position = 0 • Desired main pressure > 2 bar • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• 6,000.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
		• Synchronizing detection while the gearshift fork was controlled to engage reverse gear	• Integral that corresponds to the energy flux in the synchronization exceeds a maximum value. The integral calculation depends on synchronizing slip and duty factor of the safety valve 2	• Integral > 125	• No slipping point adaptation of clutch 1 • Multiplexer position = 0 • Control gearshift fork valve 4 >= 5% • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms		
P0746	Pressure Control Solenoid "A" Performance/ Stuck Off	• Pressure integral monitoring	• Integral of actual pressure minus desired pressure minus drain exceeds a maximum value	• Pressure integral >= 0,1 bar*s	• Desired pressure <= adapted clutch slipping point + 1 bar • Standing vehicle with accelerator pedal < 0.1% • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 300.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
		• Open-circuit check	• Desired valve current of clutch 1 exceeds a threshold simultaneous the actual valve current is smaller than a second threshold	• Desired current > 350.0 mA actual current < 50.0 mA	• Common high-side switch 1 on, not defect and voltage > 9.2 V • Gearbox subsystem 1 active • Common high-side switches not deactivated by module 2 • Terminal 15 voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM		
P0747	Pressure Control Solenoid "A" Stuck On	• Pressure buildup monitoring	• The number of successive pressure buildup failure of clutch 1 reaches a maximum value	• Counter > 2	• Engaged gear on input shaft 1 • Desired pressure >adapted clutch slipping point – 0.2 bar • Output speed < 200 RPM • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• 0.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• Short-circuit current check	• Comparison of actual valve current with desired valve current of clutch 1	• Actual current>desired current and (actual current-desired current) > 200.0 mA for more than 200.0 ms	• Common high-side switch 1 on, not defect and voltage > 9.2 V • Gearbox subsystem 1 active • Common high-side switches not deactivated by module 2 • Terminal 15 voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 200.0 ms	

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0751	Shift Solenoid "A" Performance/ Stuck Off	• Open-circuit check	• Comparison of residual current of gearbox subsystem 1 (total current at common high-side switch 1 – actual current of clutch 1) at switching point of control gearshift fork valve 1 with residual current at permanent control of control gearshift fork valve 1	• Difference of residual current <= 200.0 mA (supply voltage at common high-side 1 = 7.0 V) – 450.0 mA (supply voltage at common high-side 1.0 = 13.0 V)	• Common high-side switch 1 on, not defect and voltage > 9.2 V • Gearbox subsystem 1 active • Common high-side switches not deactivated by module 2 • Change of supply voltage < 1.0 V • Duty factor change of safety valve 1 (control of safety valve 1 is stable) <= 5.0% • Duty factor change of gearshift fork valve 2 (control of gearshift fork valve 2 is stable) <= 5.0% • Y factor change of safety valve 2 > 70.0% • Control of safety valve 2 is stable >= 50.0 ms • Duty factor change of gearshift > 500 RPM	• 300.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0756	Shift Solenoid "B" Performance/ Stuck Off	• Open-circuit check	• Comparison of residual current of gearbox subsystem 1 (total current at common high-side switch 1 – actual current of clutch 1) at switching point of control gearshift fork valve 2 with residual current at permanent control of control gearshift fork valve 2	• Difference of residual current <= 200.0 mA (supply voltage at common high-side 1.0 = 7.0 V) – 450.0 mA (supply voltage at common high-side 1.0 = 13.0 V)	• Common high-side switch 1 on, not defect and voltage > 9.2 V • Gearbox subsystem 1 active • Common high-side switches not deactivated by module 2 • Change of supply voltage < 1 V • Duty factor change of safety valve 1 (control of safety valve 1 is stable) <= 5.0% • Duty factor change of gearshift fork valve 1 (control of gearshift fork valve 1 is stable) <= 5.0% • Duty factor of control gearshift fork valve 2 > 70.0% and steady state time >= 50.0 ms • Terminal 15 voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 300.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0761	Shift Solenoid "C" Performance/ Stuck Off	• Open-circuit check	• Comparison of residual current of gearbox subsystem 2 (total current at common high-side switch 2 – actual current of clutch 2) at switching point of control gearshift fork valve 3 with residual current at permanent control of control gearshift fork valve 3	• Difference of residual current <= 200.0 mA (supply voltage at common high-side 2.0 = 7.0 V) – 450.0 mA (supply voltage at common high-side 2.0 = 13.0 V)	• Common high-side switch 2 on, not defect and voltage > 9.2 V • Gearbox subsystem 2 active • Common high-side switches not deactivated by module 2 • Change of supply voltage < 1.0 V • Duty factor change of safety valve 2 <= 5.0% (control of safety valve 2 is stable) • Duty factor change of gearshift fork valve 4 <= 5.0% (control of gearshift fork valve 4 is stable) • Duty factor of control gearshift fork valve 3 > 70.0% and steady state time >= 50.0 ms • Terminal 15 voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 300.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0766	Shift Solenoid "D" Performance/ Stuck Off	• Open-circuit check	• Comparison of residual current of gearbox subsystem 2 (total current at common high-side switch 2 – actual current of clutch 2) at switching point of control gearshift fork valve 4 with residual current at permanent control of control gearshift fork valve 4	• Difference of residual current <= 200.0 mA (supply voltage at common high-side 2.0 7.0 V) – 450.0 mA (supply voltage at common high-side 2.0 = 13.0 V)	• Common high-side switch 2 on, not defect and voltage > 9.2 V • Gearbox subsystem 2 active • Common high-side switches not deactivated by module 2 • Change of supply voltage < 1.0 V • Duty factor change of safety valve 2 <= 5.0% (control of safety valve 2 is stable) • Duty factor change of gearshift fork valve 3 <= 5.0% (control of gearshift fork valve 3 is stable) • Duty factor of control gearshift fork valve 4 > 70.0% and steady state time >= 50.0 ms • Terminal 15 voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 300.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0771	Shift Solenoid "E" Performance/ Stuck Off	• Open-circuit check	• Comparison of residual current of central control (total current at common high-side switch 3 – actual current of main pressure valve and cooling oil valve) at switching point of multiplexer valve with residual current at permanent control of multiplexer valve	• Difference of residual current <= 150.0 mA (maximum of supply voltage at common high-side 1,2 and terminal 15.0 = 7.0 V) – 300.0 mA (maximum of supply voltage at common high-side 1,2 and terminal 15 = 13.0 V)	• Common high-side switch 3 on and not defect • No short-circuit current check failure of main pressure solenoid valve • Common high-side switch 1 and 2 voltage > 9.2 V • Common high-side switches not deactivated by module 2 • Change of supply voltage < 1.0 V • Multiplexer valve is controled and steady state time >= 50.0 ms • Terminal 15 voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM		

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0776	Pressure Control Solenoid "B" Performance/ Stuck Off	• Pressure integral monitoring	• Integral of actual pressure minus desired pressure minus drain exceeds a maximum value	• Pressure integral >= 0.1 bar*s	• Desired pressure <= adapted clutch slipping point + 1 bar • Standing vehicle with accelerator pedal < 0.1% • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 300.0 ms	• 2 driving cycles
		• Open-circuit check	• Desired valve current of clutch 2 exceeds a threshold simultaneous the actual valve current is smaller than a second threshold	• Desired current> 350.0 mA actual current < 50.0 mA	• common high-side switch 2 on, not defect and voltage > 9.2 V • gearbox subsystem 2 active • common high-side switches not deactivated by module 2 • terminal 15 voltage > 9 V for more than 500 ms • engine speed > 500 rpm		

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0777	Pressure Control Solenoid "B" Stuck On	• Pressure buildup monitoring	• The number of successive pressure buildup failure of clutch 2 reaches a maximum value	• Counter > 2	• Engaged gear on input shaft 2 • Desired pressure > adapted clutch slipping point – 0.2 bar • Output speed < 200 RPM • Terminal 15 voltage > 4.0 V for more than 500 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• 0.0 ms	• 2 driving cycles
		• Short-circuit current check	• Comparison of actual valve current with desired valve current of clutch 2	• Actual current >desired current and (actual current-desired current) > 200.0 mA for more than 200.0 ms	• Common high-side switch 2 on, not defect and voltage > 9.2 V • Gearbox subsystem 2 active • Common high-side switches not deactivated by module 2 • Terminal 15 voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 200.0 ms	

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0781	1-2 Shift	• Unable to disengage the first gear	• Gearshift fork of first gear stays in shifted position in spite of control to disengage	• Gearshift fork position > synchronizing point first gear + 10.0% synchronizing point measured by a basic adjustment (first gear stays in shifted position) control gearshift fork valve 2 >= 5.0%	• Control safety valve 1 (ON) >= 20.0% • Multiplexer position = 0 • Desired main pressure > 2 bar • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• 6,000.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0782	2-3 Shift	• Unable to disengage the second gear	• Gearshift fork of second gear stays in shifted position in spite of control to disengage	• Gearshift fork position < synchronizing point second gear - 10.0% synchronizing point measured by a basic adjustment (second gear stays in shifted position) control gearshift fork valve 4 >= 5.0%	• Control safety valve 1 (ON) >= 20.0% • Multiplexer position = 1 • Desired main pressure > 2 bar • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• 6,000.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0783	3-4 Shift	• Unable to disengage the third gear	• Gearshift fork of third gear stays in shifted position in spite of control to disengage	• Gearshift fork position < synchronizing point third gear - 10% synchronizing point measured by a basic adjustment (third gear stays in shifted position) control gearshift fork valve 1 >= 5.0%	• Control safety valve 1 (ON) >= 20.0% • Multiplexer position = 0 • Desired main pressure > 2 bar • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• 6,000.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0784	4-5 Shift	• Unable to disengage the fourth gear	• Gearshift fork of fourth gear stays in shifted position in spite of control to disengage	• Gearshift fork position > synchronizing point fourth gear + 10.0% synchronizing point measured by a basic adjustment (fourth gear stays in shifted position) control gearshift fork valve 3 >= 5.0%	• Control safety valve 2 (ON) >= 20.0% • Multiplexer position = 1 • Desired main pressure > 2 bar • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• 6,000.0 ms	• 2 driving cycles
P0791	Intermediate Shaft Speed Sensor "A" Circuit	• Signal range check	• Rotational speed of input shaft 1 exceed a maximum value • Or • Rotational speed of input shaft 2 exceed a maximum value	• Rotational speed > 12,000 RPM	• Terminal 15 voltage > 4.0 V for more than 500.0 ms	• 100.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
P0797	Pressure Control Solenoid "C" Stuck On	• Short-circuit current check	• Comparison of actual valve current with desired valve current of main pressure solenoid valve	• Actual current>desired current and (actual current-desired current) > 200.0 mA for more than 300.0 ms	• Common high-side switch 3 on and not defect • Common high-side switch 1 and 2 voltage > 9.2 V • Common high-side switches not deactivated by module 2 • Terminal 15 voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 300.0 ms	• 2 driving cycles
P0829	5-6 Shift	• Unable to disengage the fifth gear	• Gearshift fork of fifth gear stays in shifted position in spite of control to disengage	• Gearshift fork position > synchronizing point fifth gear + 10% synchronizing point measured by a basic adjustment (fifth gear stays in shifted position) control gearshift fork valve 2 >= 5.0%	• Control safety valve 1(ON) >= 20.0% • Multiplexer position = 1 • Desired main pressure > 2 bar • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500 ms • Engine speed > 600 RPM for more than 500.0 ms	• 6,000.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• Unable to disengage the sixth gear	• Gearshift fork of sixth gear stays in shifted position in spite of control to disengage	• Gearshift fork position > synchronizing point sixth gear + 10.0% synchronizing point measured by a basic adjustment (sixth gear stays in shifted position) control gearshift fork valve 4 >= 5.0%	• Control safety valve 2 (ON) >= 20.0% • Multiplexer position = 0 • Desired main pressure > 2 bar • No main pressure loss • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms		
P0840	Transmission Fluid Pressure Sensor/ Switch "A" Circuit	• Signal range check	• Pressure sensor voltage clutch 1 out of plausibility range	• Voltage < 100.0 mV • Or • Voltage > 4,900.0 mV		• 300.0 ms	• 2 driving cycles
P0841	Transmission Fluid Pressure Sensor/ Switch "A" Circuit Range/ Performance	• overpressure monitoring	• Hydraulic pressure of clutch 1 exceeds a maximum value	• Pressure>= 15.5 bar	• Signal range check is correct • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 1,000.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0845	Transmission Fluid Pressure Sensor/ Switch "B" Circuit	• Pressure sensor voltage clutch 2 out of plausibility range	• Pressure sensor voltage clutch 1 out of plausibility range	• Voltage < 100.0 mV • Or • Voltage > 4,900.0 mV		• 300.0 ms	• 2 driving cycles
P0846	Transmission Fluid Pressure Sensor/ Switch "B" Circuit Range/ Performance	• Overpressure monitoring	• Hydraulic pressure of clutch 2 exceeds a maximum value	• Pressure >= 15.5 bar	• Signal range check is correct • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 80.0 ms	• 2 driving cycles
P0864	TCM Communication Circuit Range/ Performance	• Buss off detection of the micro controller			• Terminal 15 voltage > 9.0 V for more than 500.0 ms • > 500.0 ms after reset	• 1,000.0 ms	• 2 driving cycles
P0890	TCM Power Relay Sense Circuit Low	• Short-circuit current check	• Detection by hardware circuit	• Current > 8.5 A	• Terminal 15 voltage > 4.0 V for more than 500.0 ms	• 200.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P0914	Gear Shift Position Circuit	• Time out detection of the question and answer diagnosis	• If time out of the question and answer diagnosis is detected increment an event counter	• Time out threshold> 100.0 ms	• Gear message for selector lever is transmittable and selector lever message is receivable • No failure of selector lever CAN messages • Time after reset > 100.0 ms • Terminal 15 voltage > 4.0 V for more than 500.0 ms	• 300.0 ms	• 2 driving cycles
		• Plausibility check of selector lever	• Selector lever position is not equal to negation of the inverse selector lever position • Or • Selector lever position equals initialization value • Or • Selector lever position equals error value • Or • Selector lever position is equal to negation of the inverse selector lever position but no valid position	• Selector lever position == Position 1 or Position 2 or Position 3 or Position 4 or Position L	• No bus off error • No error failure of all CAN messages • No failure of selector lever CAN messages • Time after reset > 1,100.0 ms • Terminal 15 voltage > 9.0 V for more than 1,100.0 ms	• 1,000.0 ms	

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
		• Question and answer diagnosis	• Failure of question and answer diagnosis			• 1,500.0 ms	
P0919	Gear Shift Position Control Error	• Evaluation the error signal of selector lever CAN message	• Error flag of not determinable selector lever position is set		• No failure of selector lever CAN messages • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 20.0 ms	• 2 driving cycles
		• Validity check of selector lever position	• If the selector lever position is equal to negation of the inverse selector lever position but is not valid (position == L, P4, P3, P2, or P1) • And • Is not in error state (position != error) • And • Initialization value with the initialization flag not set then increment an event counter		• No failure of selector lever CAN messages • Terminal 15 voltage > 4.0 V for more than 500.0 ms		

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
		• Error detection of the question and answer diagnosis	• If the answer of the diagnosis is wrong an event counter is incremented		• No failure of selector lever CAN messages • Terminal 15 voltage > 4.0 V for more than 500.0 ms	• 100.0 ms	
		• Plausibility check of selector lever position	• If the selector lever position is not equal to negation of the inverse selector lever position • Or • Selector lever position equals initialization value but the initialization flag is not set • Or • Selector lever position equals error value then increment an event counter		• No failure of selector lever CAN messages • Terminal 15 voltage > 4.0 V for more than 500.0 ms • Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 400.0 ms	
P0929	Gear Shift Lock Solenoid/ Actuator Control Circuit "A" Range/ Performance	• Validity check of shiftlock position signal	• If the shiftlock position signal is not valid (position ! = error, deactive, active or init) increment an event counter		• No failure of selector lever CAN messages • Terminal 15 voltage > 4.0 V for more than 500.0 ms	• 20.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P2711	Unexpected Mechanical Gear Disengagement	• Unable to engage a gear on shaft 1	• The number of successive engagements of the same gear on shaft 1 exceeds a maximum value	• counter>=6	• Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms	• 0.0 ms	• 2 driving cycles
		• Unable to engage a gear on shaft 2	• The number of successive engagements of the same gear on shaft 2 exceeds a maximum value				
		• Detect disengagement of gears on shaft 1 without control	• In spite of a constant desired gear disengagement counter exceeds a maximum value	• Counter > 3	• Battery voltage > 9.0 V for more than 500.0 ms • Engine speed > 600 RPM for more than 500.0 ms • Output speed >= 12 RPM		
		• Detect disengagement of gears on shaft 2 without control	• In spite of a constant desired gear disengagement counter exceeds a maximum value				

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P2723	Pressure Control Solenoid "E" Performance/ Stuck Off	• Open-circuit check	• Residual current of gearbox subsystem 1 (total current at common high-side switch 1 – actual current of clutch 1) is smaller than a minimum value	• Residual current <= 150.0 mA (supply voltage at common high-side 1.0 = 7.0 V) – 300.0 mA (supply voltage at common high-side 1.0 = 13.0 V)	• Common high-side switch 1 on, not defect and voltage > 9.2 V • Gearbox subsystem 1 active • Common high-side switches not deactivated by module 2 • Change of supply voltage < 1.0 V • Duty factor of control gearshift fork valve 1 and 2 <= 10.0% • Duty factor of safety valve 1 >= 53% and steady state time >= 50.0 ms • Terminal 15 voltage > 9.0 V for more than 500.0 ms • engine speed > 500 RPM	• 300.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	**Fault Code Description**	**Monitor Strategy Description**	**Malfunction Criteria**	**Threshold Value**	**Secondary Parameters with Enable Conditions**	**Monitoring Time Length**	**Frequency of checks, MIL Illum**
P2732	Pressure Control Solenoid "F" Performance/ Stuck Off	• Open-circuit check	• Residual current of gearbox subsystem 2 (total current at common high-side switch 2 – actual current of clutch 2) is smaller than a minimum value	• Residual current <= 150.0 mA (supply voltage at common high-side 2.0 = 7.0 V) – 300.0 mA (supply voltage at common high-side 2.0 = 13.0 V)	• Common high-side switch 2 on, not defect and voltage > 9.2 V • Gearbox subsystem 2 active • Common high-side switches not deactivated by module 2 • Change of supply voltage < 1.0 V • Duty factor of control gearshift fork valve 3 and <= 10.0% • Duty factor of safety valve 2 >= 53% and steady state time >= 50.0 ms • Terminal 15 voltage > 9.0 V for more than 500.0 ms • Engine speed > 500 RPM	• 300.0 ms	• 2 driving cycles
U0100	Lost Communication With ECM/PCM "A"	• Time out Check	• Failure of all CAN engine messages	• Time-out for more than 490.0 ms	• No bus off error • No error failure of all CAN messages • Terminal 15 voltage > 9.0 V for more than 500.0 ms • > 500.0 ms after reset	• 490.0 ms	• 2 driving cycles

DQ-250 6F 02E							
DTC	Fault Code Description	Monitor Strategy Description	Malfunction Criteria	Threshold Value	Secondary Parameters with Enable Conditions	Monitoring Time Length	Frequency of checks, MIL Illum
			• Failure of one or more CAN engine messages (but not all CAN engine messages)	• Time-out for more than 1,010.0 ms	• No bus off error • No error failure of all CAN messages • No error failure of all CAN engine messages • Terminal 15 voltage > 9.0 V for more than 500.0 ms • > 500.0 ms after reset	• 1,010.0 ms	
			• Failure of all CAN messages but gearbox is still in position to send	• Time-out for more than 2,080.0 ms	• Terminal 15 voltage > 9.0 V for more than 500.0 ms • > 500.0 ms after reset	• 2,080.0 ms	
U0103	Lost Communication With Gear Shift Control Module "A"	• Time out check	• Failure of selector lever CAN messages	• Time-out for more than 490.0 ms	• Kein Bus off Fehler no bus off error • No error failure of all CAN messages • Terminal 15 voltage > 9.0 V for more than 500.0 ms, > 500.0 ms after reset	• 490.0 ms	• 2 driving cycles
U0404	Invalid Data Received From Gear Shift Control Module "A"	• Evaluation of selector lever CAN message counter	• If the value of message counter is permanent constant or change exceeds a threshold increment an event counter	• Maximum change of message counter > 5.0 [-]	• No failure of selector lever CAN messages • Terminal 15 voltage > 4.0 V for more than 500.0 ms	• 50.0 ms	• 2 driving cycles

3.6 Diagnostic Procedures

- ⇒ “3.6.28 Oxygen Sensor 1 After Catalytic Converter GX7 , Checking”, page 261
- ⇒ “3.6.29 Oxygen Sensor 1 Before Catalytic Converter GX10 , Checking”, page 264
- ⇒ “3.6.30 Terminal 30 Power Supply Relay J317 , Checking”, page 267
- ⇒ “3.6.31 Three Way Catalytic Converter (TWC), Checking”, page 269
- ⇒ “3.6.32 Throttle Valve Control Module GX3 , Checking”, page 270
- ⇒ “3.6.33 Vehicle Speed Signal, Checking”, page 272
- ⇒ “3.6.34 Wastegate Bypass Regulator Valve N75 , Checking”, page 274

3.6.1 Accelerator Pedal Module - GX2- , Checking

General Description

The Accelerator Pedal Position Sensor - G79- and the Accelerator Pedal Position Sensor 2 - G185- are combined in one component and integrated into the Accelerator Pedal Module - GX2- . They are used to detect the position of the accelerator pedal throughout the entire adjustment range. The Engine Control Module - J623- detects the driver’s request from these signals and uses them to calculate the injection quantity and EPC Throttle valve operation.

The Accelerator Pedal Module - GX2- contains the following components:

- Accelerator Pedal Position Sensor - G79- .
- Accelerator Pedal Position Sensor 2 - G185- .

The Accelerator Pedal Module - GX2- components cannot be serviced separately, and they must be serviced as a unit.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 16 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 204 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • CONNECT: Scan Tool. • IGNITION: ON. • CHECK: Throttle valve position closed: • SPECIFIED VALUE: 3 – 25%. • DEPRESS: Accelerator pedal slowly to WOT while observing the percentage display. The percentage display must increase uniformly. • CHECK: Throttle valve position at WOT: • SPECIFIED VALUE: 84 – 99%. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 205 . – NO: ♦ GO TO: Step 3 ⇒ page 204 .
3	• DISCONNECT: Accelerator Pedal Module - GX2- harness connector. • IGNITION: ON. • CHECK: Accelerator Pedal Module - GX2- harness connector terminals 1 to 5 and 2 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Were Values obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 204 . – NO: ♦ GO TO: Step 5 ⇒ page 205 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 4 to the Engine Control Module - J623- harness connector T94 / 53 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 6 to the Engine Control Module - J623- harness connector T94 / 54 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Accelerator Pedal Module - GX2- . Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 205 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 205 .

Step	Procedure	Result / Action to Take
5	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 13 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 15 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 74 for resistance. • CHECK: Accelerator Pedal Module - GX2- harness connector terminal 5 to the Engine Control Module - J623- harness connector T94 / 8 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 6 ⇒ page 205 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 205 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return, the repair is complete. ◆ Return vehicle to customer.

3.6.2 Automatic Glow Time Control Module - J179- and Glow Plug, Checking

General Description

The glow plugs are activated by the Engine Control Module - J623- through the Automatic Glow Time Control Module - J179- . The voltage on the individual glow plugs is adjusted over the frequency of the PWM impulses. For quick start with an ambient temperature of less than 64° F (18° C), a maximum voltage of 11.5 volts is present during preheating. This ensures that the glow plug heats up as quickly as possible (maximum two seconds) to over 1,832° F (1,000° C), thus reducing the preheating time of the engine. Post-heating is performed up

to a coolant temperature of 64° F (18° C) after engine start for a maximum of five minutes. Post-heating helps reduce hydrocarbon emissions and combustion noise during the engine warm-up phase.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Note

The Glow Plug terminal / connector is not repairable. The harness must be replaced if damaged.

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 206 . – NO: ♦ GATHER more information from customer about the complaint.
2	• Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 . – Are there fault codes present for the Glow Plugs ?	– YES: ♦ GO TO: Step 5 ⇒ page 208 . – NO: ♦ GO TO: Step 3 ⇒ page 207 .

Step	Procedure	Result / Action to Take
3	• IGNITION: OFF. • DISCONNECT: Automatic Glow Time Control Module - J179- harness connector. • IGNITION: ON. • CHECK: Automatic Glow Time Control Module - J179- harness connector terminals 6 and 11 to ground for voltage. • CHECK: Automatic Glow Time Control Module - J179- harness connector terminal 7 to battery voltage for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 207 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 209 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Automatic Glow Time Control Module - J179- harness connector terminal 9 to the Engine Control Module - J623- harness connector T94 / 20 for resistance. • CHECK: Automatic Glow Time Control Module - J179- harness connector terminal 10 to the Engine Control Module - J623- harness connector T94 / 61 for resistance. • SPECIFIED VALUE: 0.5 Ω (+/- 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Automatic Glow Time Control Module - J179- . Refer to appropriate repair manual. ◆ GO TO: Step 7 ⇒ page 209 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 7 ⇒ page 209 .

Step	Procedure	Result / Action to Take
5	• IGNITION: OFF. • DISCONNECT: Automatic Glow Time Control Module - J179- harness connector. • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • DISCONNECT: Suspect Glow Plug harness connector (per DTC stored). • CHECK: The suspect Glow Plug (per DTC stored) harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 24 for resistance (refer to appropriate wiring diagram for correct terminal and connector locations). • CHECK: The suspect Glow Plug (per DTC stored) harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / xx for resistance (refer to appropriate wiring diagram for correct terminal and connector locations). • CHECK: The suspect Glow Plug (per DTC stored) harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 36 for resistance (refer to appropriate wiring diagram for correct terminal and connector locations). • SPECIFIED VALUE: 1.3 Ω (+/- 0.3 Ω @ 20° C). – Were Values obtained?	– YES: ♦ GO TO: Step 6 ⇒ page 208 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 7 ⇒ page 209 .
6	• CHECK: Automatic Glow Time Control Module - J179- harness connector terminal (1, 2, 3, or 4) to suspect Glow Plug harness connector terminal 4 for resistance (refer to appropriate wiring diagram for correct terminal and connector locations). • SPECIFIED VALUE: 0.5 Ω (+/- 0.3 Ω). – Was Value obtained?	– YES: ♦ TIP: The Glow Plug may fail under loaded operation; please swap a known good Glow Plug prior to continuing to the next step. ♦ GO TO: Step 7 ⇒ page 209 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 7 ⇒ page 209 .

Step	Procedure	Result / Action to Take
7	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Automatic Glow Time Control Module - J179- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Automatic Glow Time Control Module - J179- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.3 Camshaft Position Sensor - G40- , Checking

General Description

Using the signal from the Camshaft Position Sensor - G40- , the precise position of the camshaft relative to the crankshaft is determined very quickly when the engine is started. Used in combination with the signal from the Engine Speed Sensor - G28- , the signal from the Camshaft Position Sensor - G40- allows the Engine Control Module - J623- to detect which cylinder is at TDC. The fuel can be injected into the corresponding cylinder and ignited.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 210 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Camshaft Position Sensor - G40- harness connector. • IGNITION: ON. • CHECK: Camshaft Position Sensor - G40- harness connector terminals 1 to 3 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: About 5.0 V. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 210 . – NO: ◆ GO TO: Step 4 ⇒ page 210 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor - G40- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 44 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Camshaft Position Sensor - G40- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 211 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 211 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Camshaft Position Sensor - G40- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 10 for resistance. • CHECK: Camshaft Position Sensor - G40- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 51 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 211 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 211 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return, the repair is complete. ◆ Return vehicle to customer.

3.6.4 CAN-Bus Terminal Resistance, Checking

General Description

The Engine Control Module - J623- communicates with all databus capable control modules via a CAN databus.

These databus capable control modules are connected via two data bus wires which are twisted together (CAN_High and CAN_Low), and exchange information (messages). Missing information on the databus is recognized as a malfunction and may be stored by the Engine Control Module - J623- and the other control modules connected to the CAN-bus.

Trouble-free operation of the CAN-bus requires that it have a terminal resistance. This central terminal resistor is located in the Engine Control Module - J623- .

Special tools and workshop equipment required

◆ Multimeter.

◆ Wiring Diagram.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .

- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Note

- *The 2010 1K2 (Jetta) and 2010 – 2014 AJ5 (Jetta SW) and 2010 – 2014 5K1 (Golf) have a dedicated Data Bus on Board Diagnostic Interface - J533- and it is not contained within any other module.*
- *The 2011 – 2014 162 (Jetta) have the Data Bus on Board Diagnostic Interface - J533- contained within the Vehicle Electrical System Control Module - J519- .*
- *The 5C1 / 5C7 (Beetle, Beetle Convertible) have the Data Bus on Board Diagnostic Interface - J533- contained within the Instrument Cluster Control Module - J285- .*

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 212 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: As per vehicle being tested, the Data Bus on Board Diagnostic Interface - J533- , or Vehicle Electrical System Control Module - J519- , or Instrument Cluster Control Module - J285- harness connectors. • The Engine Control Module - J623- must remain connected for the following step. • For the 2010 1K2, 2010 – 2014 AJ5 / 5K1, CHECK: Data Bus on Board Diagnostic Interface - J533- harness connector terminals 6 to 16 for resistance. • For the 2011 – 2014 162, CHECK: Vehicle Electrical System Control Module - J519- harness connector terminals 18 to 19 for resistance. • For the 5C1 / 5C7, CHECK: Instrument Cluster Control Module - J285- harness connector terminals 29 to 28 for resistance. • SPECIFIED VALUE: 60 – 72 Ω (@ approx. 20° C). – Was Value obtained?	– YES: ◆ CONDITION: May be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 214 . – NO: ◆ GO TO: Step 3 ⇒ page 213 .

Step	Procedure	Result / Action to Take
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • For the 2010 1K2, 2010 – 2014 AJ5 / 5K1, CHECK: Data Bus on Board Diagnostic Interface - J533- harness connector terminal 6 to the Engine Control Module - J623- harness connector T94 / 67 for resistance. • For the 2010 1K2, 2010 – 2014 AJ5 / 5K1, CHECK: Data Bus on Board Diagnostic Interface - J533- harness connector terminal 16 to the Engine Control Module - J623- harness connector T94 / 68 for resistance. • For the 2011 – 2014 162, CHECK: Vehicle Electrical System Control Module - J519- harness connector terminal 18 to the Engine Control Module - J623- harness connector T94 / 67 for resistance. • For the 2011 – 2014 162, CHECK: Vehicle Electrical System Control Module - J519- harness connector terminal 19 to the Engine Control Module - J623- harness connector T94 / 68 for resistance. • For the 5C1 / 5C7, CHECK: Instrument Cluster Control Module - J285- harness connector terminal 29 to the Engine Control Module - J623- harness connector T94 / 67 for resistance. • For the 5C1 / 5C7, CHECK: Instrument Cluster Control Module - J285- harness connector terminal 28 to the Engine Control Module - J623- harness connector T94 / 68 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 214 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 214 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: As per vehicle being tested, the Data Bus on Board Diagnostic Interface - J533- , or Vehicle Electrical System Control Module - J519- , or Instrument Cluster Control Module - J285- harness connectors for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: As per vehicle being tested, the Data Bus on Board Diagnostic Interface - J533- , or Vehicle Electrical System Control Module - J519- , or Instrument Cluster Control Module - J285- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.5 CAN-Bus Terminal Resistance, Powertrain, Checking

General Description

The Engine Control Module - J623- communicates with all databus capable control modules via a CAN databus.

These databus capable control modules are connected via two data bus wires which are twisted together (CAN_High and CAN_Low), and exchange information (messages). Missing information on the databus is recognized as a malfunction and may be stored by the Engine Control Module - J623- and the other control modules connected to the CAN-bus.

Trouble-free operation of the CAN-bus requires that it have a terminal resistance. This central terminal resistor is located in the Engine Control Module - J623- .

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.

- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 215 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • The Engine Control Module - J623- must remain connected for the following step. The central terminal resistor is located in the Engine Control Module - J623- . • REMOVE: Transmission Control Module . Refer to appropriate repair manual. • CHECK: Transmission Control Module harness connector terminals 15 to 10 for resistance. • SPECIFIED VALUE: 60 – 72 Ω (@ approx. 20° C). – Was Value obtained?	– YES: ◆ CONDITION: May be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 216 . – NO: ◆ GO TO: Step 3 ⇒ page 215 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: CAN bus circuit between the Transmission Control Module harness connector terminal 15 and the Engine Control Module - J623- harness connector T94 / 67 for resistance. • CHECK: CAN bus circuit between the Transmission Control Module harness connector terminal 10 and the Engine Control Module - J623- harness connector T94 / 68 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 216 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 216 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Transmission Control Module harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Transmission Control Module . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.6 Charge Air Pressure Actuator Position Sensor - G581- , Checking

General Description

The Charge Air Pressure Actuator Position Sensor - G581- delivers the position of the guide vanes of the turbocharger to the Engine Control Module - J623- . Together with the Charge Air Pressure Sensor - G31- , this allows conclusions about the state of boost pressure control.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 217 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Charge Air Pressure Actuator Position Sensor - G581- harness connector. • IGNITION: ON. • CHECK: Charge Air Pressure Actuator Position Sensor - G581- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 217 . – NO: ◆ GO TO: Step 4 ⇒ page 217 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Charge Air Pressure Actuator Position Sensor - G581- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 58 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Charge Air Pressure Actuator Position Sensor - G581- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 218 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 218 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Charge Air Pressure Actuator Position Sensor - G581- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 53 for resistance. • CHECK: Charge Air Pressure Actuator Position Sensor - G581- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 25 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 218 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 218 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.7 Differential Pressure Sensor - G505- , Checking

General Description

Exhaust gas temperature sensors are positive temperature coefficient (PTC) sensors. They measure the temperature of the exhaust gas. The Engine Control Module - J623- uses the signals from exhaust gas temperature sensors to calculate the amount of contamination in the diesel particulate filter, also to protect the turbocharger from unacceptably high exhaust gas temperatures. The diesel particulate filter contamination status is calculated using these signals from the exhaust gas temperature sensors, together with the signals from, the Exhaust Pressure Sensor 1 - G450- , the Differential Pressure Sensor - G505- , the Mass Airflow Sensor - G70- , and the Oxygen Sensor 1 Before Catalytic Converter - GX10- . The signal also serves as a component protection in order to protect the diesel particulate filter and turbocharger from excessively high exhaust gas temperatures.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.

- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 219 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Differential Pressure Sensor - G505- harness connector. • IGNITION: ON. • CHECK: Differential Pressure Sensor - G505- harness connector terminals 1 to 2 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: About 5.0 V. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 219 . – NO: ◆ GO TO: Step 4 ⇒ page 219 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • For 2010 – 2014 5K1 (Golf) only, CHECK: Differential Pressure Sensor - G505- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 11 for resistance. • For all others, CHECK: Differential Pressure Sensor - G505- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 34 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Differential Pressure Sensor - G505- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 220 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 220 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Differential Pressure Sensor - G505- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 14 for resistance. • CHECK: Differential Pressure Sensor - G505- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 79 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 220 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 220 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.8 EGR Temperature Sensor - G98- , Checking

General Description

The EGR Temperature Sensor - G98- supplies exhaust gas recirculation system temperature data to the Engine Control Module - J623- , which is used as an input in deciding on the correct EGR valve setting.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 221 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: EGR Temperature Sensor - G98- harness connector. • CHECK: EGR Temperature Sensor - G98- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 215 Ω (+/- 50 Ω @ approx. 20° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 221 . – NO: ◆ REPLACE: EGR Temperature Sensor - G98- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 221 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: EGR Temperature Sensor - G98- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 54 for resistance. • CHECK: EGR Temperature Sensor - G98- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 55 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ TIP: The EGR Temperature Sensor - G98- may fail under loaded operation; please swap a known good EGR Temperature Sensor - G98- prior to continuing to the next step. ◆ GO TO: Step 4 ⇒ page 221 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 221 .
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return, the repair is complete. ◆ Return vehicle to customer.

3.6.9 EGR Valve 1 - GX5 - , Checking

General Description

The EGR Vacuum Regulator Solenoid Valve - N18- is a positioning motor used to actuate the exhaust gas recirculation valve. The exhaust gas recirculation rate is determined by means of a performance map in the Engine Control Module - J623- . The EGR Vacuum Regulator Solenoid Valve - N18- receives a pulse-width modulated signal from the Engine Control Module - J623- to control the flow of exhaust gas into the intake manifold. The EGR Potentiometer - G212- monitors the position of the EGR Valve 1 - GX5- and reports the EGR Valve 1 - GX5- position to the Engine Control Module - J623- .

The EGR Valve 1 - GX5- contains the following components:

- EGR Vacuum Regulator Solenoid Valve - N18- .
- EGR Potentiometer - G212- .

The EGR Valve 1 - GX5- components cannot be serviced separately, and they must be serviced as a unit.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 223 . – NO: ♦ GATHER more information from customer about the complaint.

Step	Procedure	Result / Action to Take
2	• IGNITION: OFF. • DISCONNECT: EGR Valve 1 - GX5 - harness connector. • IGNITION: ON. • CHECK: EGR Valve 1 - GX5 - harness connector terminals 1 to 3 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: About 5.0 V. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 223 . – NO: ◆ GO TO: Step 4 ⇒ page 223 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: EGR Valve 1 - GX5 - harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 4 for resistance. • CHECK: EGR Valve 1 - GX5 - harness connector terminal 5 to the Engine Control Module - J623- harness connector T60 / 57 for resistance. • CHECK: EGR Valve 1 - GX5 - harness connector terminal 6 to the Engine Control Module - J623- harness connector T60 / 19 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: EGR Valve 1 - GX5 - . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 224 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 224 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: EGR Valve 1 - GX5 - harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 25 for resistance. • CHECK: EGR Valve 1 - GX5 - harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 53 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 224 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 224 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.10 EGR Valve 2 - GX6- , Checking

General Description

The Valve 2 For EGR - N213- is a positioning motor used to actuate the exhaust gas recirculation valve. The exhaust gas recirculation rate is determined by means of a performance map in the Engine Control Module - J623- . The Valve 2 For EGR - N213- receives a pulse-width modulated signal from the Engine Control Module - J623- to control the flow of exhaust gas into the intake manifold.

The EGR Valve 2 - GX6- contains the following components:

♦ Valve 2 For EGR - N213- .

♦ Exhaust Gas Recirculation Position Sensor 2 - G466- .

The EGR Valve 2 - GX6- components cannot be serviced separately, and they must be serviced as a unit.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.

- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 225 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: EGR Valve 2 - GX6- harness connector. • IGNITION: ON. • CHECK: EGR Valve 2 - GX6- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 225 . – NO: ◆ GO TO: Step 4 ⇒ page 225 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: EGR Valve 2 - GX6- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 34 for resistance. • CHECK: EGR Valve 2 - GX6- harness connector terminal 5 to the Engine Control Module - J623- harness connector T60 / 41 for resistance. • CHECK: EGR Valve 2 - GX6- harness connector terminal 6 to the Engine Control Module - J623- harness connector T60 / 49 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE EGR Valve 2 - GX6- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 226 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 226 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: EGR Valve 2 - GX6- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 25 for resistance. • CHECK: EGR Valve 2 - GX6- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 53 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 226 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 226 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.11 Engine Coolant Temperature Sensor - G62- , Checking

General Description

The Engine Coolant Temperature Sensor - G62- sends information about the current coolant temperature to the Engine Control Module - J623- . It uses the coolant temperature as a correction value for calculating the injection quantity.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 227 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Engine Coolant Temperature Sensor - G62- harness connector. • CHECK: Engine Coolant Temperature Sensor - G62- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 2,250 Ω (+/- 750 Ω @ approx. 20° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 227 . – NO: ◆ REPLACE: Engine Coolant Temperature Sensor - G62- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 228 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • For 2010 – 2014 5K1 (Golf), CHECK: Engine Coolant Temperature Sensor - G62- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 54 for resistance. • For 2010 – 2014 5K1 (Golf), CHECK: Engine Coolant Temperature Sensor - G62- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 43 for resistance. • For all others, CHECK: Engine Coolant Temperature Sensor - G62- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 43 for resistance. • For all others, CHECK: Engine Coolant Temperature Sensor - G62- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 54 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ TIP: The Engine Coolant Temperature Sensor - G62- may fail under loaded operation; please swap a known good Engine Coolant Temperature Sensor - G62- prior to continuing to the next step. ◆ GO TO: Step 4 ⇒ page 228 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 228 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.12 Engine Coolant Temperature Sensor On Radiator Outlet - G83- , Checking

General Description

The Engine Coolant Temperature Sensor On Radiator Outlet - G83- sends information about the current coolant temperature to the Engine Control Module - J623- . It uses the coolant temperature as a correction value for calculating the injection quantity.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 229 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Engine Coolant Temperature Sensor On Radiator Outlet - G83- harness connector. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet - G83- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 2,250 Ω (+/- 750 Ω @ approx. 20° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 229 . – NO: ◆ REPLACE: Engine Coolant Temperature Sensor On Radiator Outlet - G83- . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 230 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet - G83- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 16 for resistance. • CHECK: Engine Coolant Temperature Sensor On Radiator Outlet - G83- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 89 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ TIP: The Engine Coolant Temperature Sensor On Radiator Outlet - G83- may fail under loaded operation; please swap a known good Engine Coolant Temperature Sensor On Radiator Outlet - G83- prior to continuing to the next step. ◆ GO TO: Step 4 ⇒ page 230 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 230 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.13 Engine Speed Sensor - G28- , Checking

General Description

The Engine Speed Sensor - G28- detects rpm and reference marks from a toothed wheel on the crankshaft. Without an engine speed signal, the engine will not start. If the engine speed signal fails while the engine is running, the engine will stop immediately.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers concern. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 231 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • CONNECT: Scan Tool. • START or CRANK: Engine. • CHECK: Engine rpm. • SPECIFIED VALUE: Cranking or Idle rpm. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ CONDITION: May be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 232 . – NO: ◆ GO TO: Step 3 ⇒ page 231 .
3	• DISCONNECT: Engine Speed Sensor - G28- harness connector. • IGNITION: ON. • CHECK: Engine Speed Sensor - G28- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 231 . – NO: ◆ GO TO: Step 5 ⇒ page 232 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Engine Speed Sensor - G28- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 52 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REMOVE: Engine Speed Sensor - G28- . Refer to appropriate repair manual. ◆ CHECK: Engine Speed Sensor - G28- sensor wheel for proper seating, damage and/or run - out. Refer to appropriate repair manual. ◆ Sensor wheel OK. ◆ REPLACE: Engine Speed Sensor - G28- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 232 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 232 .

Step	Procedure	Result / Action to Take
5	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Engine Speed Sensor - G28- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 25 for resistance. • CHECK: Engine Speed Sensor - G28- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 53 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 6 ⇒ page 232 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 232 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.14 Exhaust Door Control Unit - J883- , Checking

General Description

This procedure can be used to diagnose the Exhaust Door Control Unit - J883- , which is controlled with dedicated circuitry between it and the Engine Control Module - J623- .

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.

- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 233 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Exhaust Door Control Unit - J883- harness connector. • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Exhaust Door Control Unit - J883- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 14 for resistance. • CHECK: Exhaust Door Control Unit - J883- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 76 for resistance. • CHECK: Exhaust Door Control Unit - J883- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 79 for resistance. • CHECK: Exhaust Door Control Unit - J883- harness connector terminal 4 to the Engine Control Module - J623- harness connector T94 / 7 for resistance. • CHECK: Exhaust Door Control Unit - J883- harness connector terminal 5 to the Engine Control Module - J623- harness connector T94 / 29 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Exhaust Door Control Unit - J883- . Refer to appropriate repair manual. ◆ GO TO: Step 3 ⇒ page 234 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 3 ⇒ page 234 .

Step	Procedure	Result / Action to Take
3	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.15 Exhaust Gas Temperature Sensors , Checking

General Description

Exhaust gas temperature sensors are positive temperature coefficient (PTC) sensors. They measure the temperature of the exhaust gas. The Engine Control Module - J623- uses the signals from the exhaust gas temperature sensors to calculate the amount of contamination in the diesel particulate filter. They also protect the turbocharger from unacceptably high exhaust gas temperatures. The diesel particulate filter contamination status is calculated using these signals from the exhaust gas temperature sensors, together with the signals from; the Exhaust Pressure Sensor 1 - G450- , the Differential Pressure Sensor - G505- , the Mass Airflow Sensor - G70- , and the Oxygen Sensor 1 Before Catalytic Converter - GX10- . The signal from the exhaust gas temperature sensors also serves as component protection in order to protect the diesel particulate filter and turbocharger from excessively high exhaust gas temperatures.

The Exhaust Gas Temperature Sensors include:

♦ Exhaust Gas Temperature Sensor 1 - G235- .

♦ Exhaust Gas Temperature Sensor 2 - G448- .

♦ Exhaust Gas Temperature Sensor 3 - G495- .

♦ Exhaust Gas Temperature Sensor 4 - G648- .

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 235 . – NO: ◆ GATHER more Information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Suspect Exhaust Gas Temperature Sensor harness connector. • CHECK: Suspect Exhaust Gas Temperature Sensor component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 220 Ω (+/- 50 Ω @ approx. 20° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 235. – NO: ◆ REPLACE: Exhaust Gas Temperature Sensor . Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 236.
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Suspect Exhaust Gas Temperature Sensor harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 89 for resistance. • CHECK: Suspect Exhaust Gas Temperature Sensor harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / xx for resistance (refer to appropriate wiring diagram for correct terminal and connector locations). • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ TIP: The Exhaust Gas Temperature Sensor may fail under loaded operation; please swap a known good Exhaust Gas Temperature Sensor prior to continuing to the next step. ◆ GO TO: Step 4 ⇒ page 236 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 236 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.16 Exhaust Pressure Sensor 1 - G450- , Checking

General Description

Exhaust gas temperature sensors are positive temperature coefficient (PTC) sensors. They measure the temperature of the exhaust gas. The Engine Control Module - J623- uses the signals from the exhaust gas temperature sensors to calculate the amount of contamination in the diesel particulate filter. They also protect the turbocharger from unacceptably high exhaust gas temperatures. The diesel particulate filter contamination status is calculated using these signals from the exhaust gas temperature sensors, together with the signals from; the Exhaust Pressure Sensor 1 - G450- , the Differential Pressure Sensor - G505- , the Mass Airflow Sensor - G70- , and the Oxygen Sensor 1 Before Catalytic Converter - GX10- . The signal from the exhaust gas temperature sensors also serves as component protection in order to protect the diesel particulate filter and turbocharger from excessively high exhaust gas temperatures.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".

- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 237 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Exhaust Pressure Sensor 1 - G450- harness connector. • IGNITION: ON. • CHECK: Exhaust Pressure Sensor 1 - G450- harness connector terminals 1 to 2 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 237 . – NO: ◆ GO TO: Step 4 ⇒ page 237 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • For 2010 – 2014 5K1 (Golf), CHECK: Exhaust Pressure Sensor 1 - G450- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 34 for resistance. • For all others, CHECK: Exhaust Pressure Sensor 1 - G450- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 11 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Exhaust Pressure Sensor 1 - G450- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 238 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 238 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Exhaust Pressure Sensor 1 - G450- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 14 for resistance. • CHECK: Exhaust Pressure Sensor 1 - G450- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 79 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 238 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 238 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.17 Fuel Delivery Unit - GX1- / Fuel Pump Relay - J17- , Checking

General Description

The Fuel Pump Relay - J17- is cycled on and off by the Engine/Motor Control Module - J623- , thereby providing power to the Transfer Fuel Pump - G6- , which is contained within the Fuel Delivery Unit - GX1- .

The Fuel Delivery Unit - GX1- contains the following components:

- ♦ Transfer Fuel Pump - G6- .
- ♦ Fuel Level Sensor - G- .

The Fuel Delivery Unit - GX1- components cannot be serviced separately, and they must be serviced as a unit.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.

- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 239 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • REMOVE: Fuel Pump Relay - J17- . Refer to appropriate repair manual. • IGNITION: ON. • CHECK: Fuel Pump Relay - J17- socket terminals 3/30 and 1/86 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 239 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 240 .
3	• CONNECT: Jumper wire, between the Fuel Pump Relay - J17- socket terminals 3/30 and 5/87. • IGNITION: ON. • SPECIFIED VALUE: Transfer Fuel Pump - G6- should be heard running. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO Step 4 ⇒ page 239 . – NO: ◆ GO TO: Step 5 ⇒ page 240 .
4	• DISCONNECT: Jumper wire, between the Fuel Pump Relay - J17- socket terminals 3/30 and 5/87. • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Fuel Pump Relay - J17- socket terminal 2/85 to the Engine Control Module - J623- harness connector T94 / 46 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω) – Was Value obtained?	– YES: ◆ REPLACE: Fuel Pump Relay - J17- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 240 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 240 .

Step	Procedure	Result / Action to Take
5	• DISCONNECT: Jumper wire, between the Fuel Pump Relay - J17- socket terminals 3/30 and 5/87. • DISCONNECT: Fuel Delivery Unit - GX1- harness connector. • CHECK: Fuel Pump Relay - J17- socket terminal 5/87 to the Fuel Delivery Unit - GX1- harness connector terminal 1 for resistance. • CHECK: Fuel Delivery Unit - GX1- harness connector terminal 5 to ground for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Fuel Delivery Unit - GX1- . Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 240 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 240 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.18 Fuel Injectors , Checking

General Description

The Fuel Injectors are controlled by the Engine Control Module - J623- and are mounted normally in the cylinder head. The fuel injectors spray high-pressure atomized fuel directly into the combustion chamber.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.
- ♦ LED Test Lamp.

Test requirements

- Fuses OK.
- Battery voltage OK.

- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 241 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Harness connector from suspect Fuel Injector . • CHECK: Suspect Fuel Injector component connector terminals 1 to 2 for resistance (refer to appropriate wiring diagram for correct terminal and connector locations). • SPECIFIED VALUE: 150 – 200 kΩ (@ approx. 20° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 241 . – NO: ◆ REPLACE: Suspect Fuel Injector (s). Refer to appropriate repair manual. ◆ GO TO: Step 4 ⇒ page 242 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Suspect Fuel Injector harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / xx for resistance (refer to appropriate wiring diagram for correct terminal and connector locations). • CHECK: Suspect Fuel Injector harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / xx for resistance (refer to appropriate wiring diagram for correct terminal and connector locations). • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ TIP: The Fuel Injector may fail under loaded operation; please swap a known good Fuel Injector prior to continuing to the next step. ◆ GO TO: Step 4 ⇒ page 242 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 4 ⇒ page 242 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.19 Fuel Metering Valve - N290- , Checking

General Description

The Engine Control Module - J623- regulates the Fuel Metering Valve - N290- directly at the high pressure fuel pump to control the low pressure flow inside the high pressure fuel pump.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 243 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Fuel Metering Valve - N290- harness connector. • CHECK: Fuel Metering Valve - N290- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 0.5 – 11 Ω (+/- 0.4 Ω @ approx. 20° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 243 . – NO: ◆ REPLACE: Fuel Metering Valve - N290- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 244 .
3	• IGNITION: ON. • CHECK: Fuel Metering Valve - N290- harness connector terminal 2 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 243 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 244 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Fuel Metering Valve - N290- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 60 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ TIP: The Fuel Metering Valve - N290- may fail under loaded operation; please swap a known good Fuel Metering Valve - N290- prior to continuing to the next step. ◆ GO TO: Step 5 ⇒ page 244 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 244 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.20 Fuel Pressure Regulator Valve - N276- , Checking

General Description

The Engine Control Module - J623- regulates the Fuel Pressure Regulator Valve - N276- , which is mounted on the fuel pressure rail. The Engine Control Module - J623- uses the fuel pressure input from the Fuel Pressure Sensor - G247- , which is also mounted on the fuel pressure rail.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 245 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Fuel Pressure Regulator Valve - N276- harness connector. • CHECK: Fuel Pressure Regulator Valve - N276- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 0.5 – 11 Ω (+/- 0.4 Ω @ approx. 20° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 245 . – NO: ◆ REPLACE: Fuel Pressure Regulator Valve - N276- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 246 .
3	• IGNITION: ON. • CHECK: Fuel Pressure Regulator Valve - N276- harness connector terminal 2 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 245 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 246 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Fuel Pressure Regulator Valve - N276- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 45 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ TIP: The Fuel Pressure Regulator Valve - N276- may fail under loaded operation; please swap a known good Fuel Pressure Regulator Valve - N276- prior to continuing to the next step. ◆ GO TO: Step 5 ⇒ page 246 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 246 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.21 Fuel Pressure Sensor - G247- , Checking

General Description

The Fuel Pressure Sensor - G247- measures the fuel pressure in the high-pressure fuel system. The Engine Control Module - J623- analyzes the signal and regulates the fuel high pressure through the Fuel Pressure Regulator Valve - N276- and the Fuel Metering Valve - N290- in the high pressure fuel pump.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 247 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Fuel Pressure Sensor - G247- harness connector. • IGNITION: ON. • CHECK: Fuel Pressure Sensor - G247- harness connector terminals 1 to 3 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: About 5.0 V. – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 247 . – NO: ◆ GO TO Step 4 ⇒ page 247 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Fuel Pressure Sensor - G247- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 40 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Fuel Pressure Sensor - G247- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 248 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 248 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Fuel Pressure Sensor - G247- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 53 for resistance. • CHECK: Fuel Pressure Sensor - G247- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 25 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ GO TO: Step 5 ⇒ page 248 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 248 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.22 Fuel Pump Relay 2 / Fuel Pump 2 , Checking

General Description

The Fuel Pump Relay 2 provides power to the Fuel Pump 2 as it is cycled on and off by the Engine/Motor Control Module - J623- as necessary.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Note

- *The 2010 1K2 (Jetta) uses the 1AV Fuel Injection System Engine Control Module - J382- / Auxiliary Fuel Pump - V393- .*
- *The 2011 – 2014 162 (Jetta) and the 2010 – 2014 5K1 (Golf) uses the Fuel Pump Relay 2 - J49- / Fuel Pump 2 - V277- .*
- *The 2010 – 2014 AJ5 (Jetta SW) uses the Auxiliary Fuel Pump Relay - J832- / Auxiliary Fuel Pump - V393- .*
- *The 5C1 / 5C7 (Beetle, Beetle Convertible) uses the Fuel Pump Relay 2 - J49- / Auxiliary Fuel Pump - V393- .*

Note

The Fuel Pump Relay 2 and the Fuel Pump 2 will be used in this pinpoint for simplicity and consistency.

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 249 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • REMOVE: Fuel Pump Relay 2 from fuse box. Refer to appropriate repair manual. • IGNITION: ON. • CHECK: Fuel Pump Relay 2 socket terminals 1/86 and 3/30 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 249 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 250 .
3	• CONNECT: Jumper wire, between the Fuel Pump Relay 2 socket terminals 3/30 and 5/87. • IGNITION: ON. • SPECIFIED VALUE: Fuel Pump 2 should be heard running. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 250 . – NO: ◆ GO TO: Step 5 ⇒ page 250 .

Step	Procedure	Result / Action to Take
4	• DISCONNECT: Jumper wire, between the Fuel Pump Relay 2 socket terminals 3/30 and 5/87. • REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Fuel Pump Relay 2 socket terminal 2/85 to the Engine Control Module - J623- harness connector T60 / 15 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ♦ REPLACE: Fuel Pump Relay 2 . Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 250 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 250 .
5	• DISCONNECT: Jumper wire, between the Fuel Pump Relay 2 socket terminals 3/30 and 5/87. • DISCONNECT: Fuel Pump Relay 2 harness connector. • CHECK: Fuel Pump Relay 2 socket terminal 5/87 to the Fuel Pump Relay 2 harness connector terminal 2 for resistance. • CHECK: Fuel Pump Relay 2 harness connector terminal 1 to ground for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Fuel Pump 2 . Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 250 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 250 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.23 Fuel Temperature Sensor - G81- , Checking

General Description

The Fuel Temperature Sensor - G81- sends information about the current fuel temperature to the Engine Control Module - J623- .

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 251 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Fuel Temperature Sensor - G81- harness connector. • CHECK: Fuel Temperature Sensor - G81- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 2,250 Ω (+/- 750 @ approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 252 . – NO: ♦ REPLACE: Fuel Temperature Sensor - G81- . Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 252 .

Step	Procedure	Result / Action to Take
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Fuel Temperature Sensor - G81- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 53 for resistance. • CHECK: Fuel Temperature Sensor - G81- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 42 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ TIP: The Fuel Temperature Sensor - G81- may fail under loaded operation; please swap a known good Fuel Temperature Sensor - G81- prior to continuing to the next step. ♦ GO TO: Step 4 ⇒ page 252 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 252 .
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.24 Intake Flap Control Unit - GX14- , Checking

General Description

The Intake Flap Control Unit - GX14- is controlled by the Engine Control Module - J623- to increase the EGR rate by reducing the overpressure in the intake manifold. The Intake Manifold Runner Position Sensor - G336- provides the position of the Intake Flap Motor - V157- to the Engine Control Module - J623- .

The Intake Flap Control Unit - GX14- contains the following components:

♦ Intake Flap Motor - V157- .

♦ Intake Manifold Runner Position Sensor - G336- .

The Intake Flap Control Unit - GX14- components cannot be serviced separately, and they must be serviced as a unit.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 253 . – NO: ♦ GATHER more Information from customer about the complaint.
2	• IGNITION: OFF. • REMOVE: Intake Flap Control Unit - GX14- far enough so that the harness connector terminals are accessible. • DISCONNECT: Intake Flap Control Unit - GX14- harness connector. • IGNITION: ON. • CHECK: Intake Flap Control Unit - GX14- harness connector terminals 1 to 3 for voltage. • SPECIFIED VALUE: About 5.0 V. • IGNITION: OFF. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 254 . – NO: ♦ GO TO: Step 4 ⇒ page 254 .

Step	Procedure	Result / Action to Take
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Flap Control Unit - GX14- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 27 for resistance. • CHECK: Intake Flap Control Unit - GX14- harness connector terminal 4 to the Engine Control Module - J623- harness connector T60 / 35 for resistance. • CHECK: Intake Flap Control Unit - GX14- harness connector terminal 5 to the Engine Control Module - J623- harness connector T60 / 50 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω) – Were Values obtained?	– YES: ♦ REPLACE: Intake Flap Control Unit - GX14- . Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 254 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 254 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Flap Control Unit - GX14- harness connector terminal 1 to the Engine Control Module - J623- harness connector T60 / 10 for resistance. • CHECK: Intake Flap Control Unit - GX14- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 51 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω) – Were Values obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 254 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 254 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.25 Intake Manifold Sensor - GX9- , Checking

General Description

The air mass and charge pressure are two factors used for engine load management. For this purpose, there are several sensors with absolutely identical functions. They measure the intake air temperature and the intake manifold pressure. The first sender unit is located upstream of the Throttle Valve Control Module - J338/GX3- in the Intake Manifold Sensor - GX9- . They measure the pressure and temperature of the air in each individual cylinder bank. The values measured here correspond to the actual air mass in the cylinder bank(s).

The Intake Manifold Sensor - GX9- contains the following components:

- Intake Air Temperature Sensor - G42- .
- Charge Air Pressure Sensor - G31- .

The Intake Manifold Sensor - GX9- components cannot be serviced separately, and they must be serviced as a unit.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 256 . – NO: ♦ GATHER more information from customer about the complaint.

Step	Procedure	Result / Action to Take
2	• IGNITION: OFF. • DISCONNECT: Intake Manifold Sensor - GX9- harness connector. • IGNITION: ON. • CHECK: Intake Manifold Sensor - GX9- harness connector terminals 1 to 3 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: About 5.0 V. – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 256 . – NO: ♦ GO TO: Step 4 ⇒ page 256 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Manifold Sensor - GX9- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 30 for resistance. • CHECK: Intake Manifold Sensor - GX9- harness connector terminal 4 to the Engine Control Module - J623- harness connector T94 / 83 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Intake Manifold Sensor - GX9- . Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 257 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 257 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Intake Manifold Sensor - GX9- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 66 for resistance. • CHECK: Intake Manifold Sensor - GX9- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 17 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ GO TO: Step 5 ⇒ page 257 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 257 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return, the repair is complete. ◆ Return vehicle to customer.

3.6.26 Mass Airflow Sensor - G70- , Checking

General Description

The signal from the Mass Airflow Sensor - G70- is used in the Engine Control Module - J623- to calculate the volumetric efficiency. Based on the volumetric efficiency, and taking into consideration the lambda value and ignition timing, the Engine Control Module - J623- calculates the engine torque.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 258 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • CONNECT: Scan tool . • START: Engine and let Idle. • CHECK: The air flow quantity of the Mass Air Flow Sensor - G70- . • SPECIFIED VALUE: About 6 to 9 g/s. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ CONDITION: May be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 259 . – NO: ◆ GO TO: Step 3 ⇒ page 258 .
3	• DISCONNECT: Mass Air Flow Sensor - G70- harness connector. • IGNITION: ON. • CHECK: Mass Air Flow Sensor - G70- harness connector terminal 5 to ground for voltage. • SPECIFIED VALUE: Battery voltage. • IGNITION: OFF. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 258 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 259 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Mass Air Flow Sensor - G70- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 18 for resistance. • CHECK: Mass Air Flow Sensor - G70- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 23 for resistance. • CHECK: Mass Air Flow Sensor - G70- harness connector terminal 4 to the Engine Control Module - J623- harness connector T94 / 39 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Mass Airflow Sensor - G70- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 259 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 259 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return, the repair is complete. ◆ Return vehicle to customer.

3.6.27 Outside Air Temperature Sensor - G17- , Checking

General Description

The ambient or Outside Air Temperature Sensor - G17- is a negative temperature coefficient (NTC) sensor that informs the semiautomatic / automatic temperature control system of outside air temperature. An NTC sensor resistance decreases as the temperature increases, and the sensor resistance increases as the temperature decreases. The computer uses this input along with different in-car temperature sensors to control temperature and blower speed. When there is a problem with this sensor, performance will suffer and the A/C compressor clutch may not engage.

Special tools and workshop equipment required

- ◆ Multimeter.
- ◆ Wiring Diagram.
- ◆ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .

- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Note

- *The 2011 – 2014 162 (Jetta), 2010 – 2014 5K1 (Golf) use the T32 cluster connector.*
- *The 2013 – 2014 5C1 (Beetle) uses the T32b cluster connector.*
- *The 2010 1K2 (Jetta), 2010 – 2014 AJ5 (Jetta SW), 2013 – 2014 5C7 (Beetle convertible) use the T32c cluster connector.*

Note

The T32 cluster connector designation will be used for simplicity and consistency.

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 260 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Outside Air Temperature Sensor - G17- harness connector. • CHECK: Outside Air Temperature Sensor - G17- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 1,300 Ω (+/- 500 Ω @ approx. 20° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 260 . – NO: ♦ REPLACE: Outside Air Temperature Sensor - G17- . Refer to appropriate repair manual. ♦ GO TO: Step 4 ⇒ page 261 .
3	• REMOVE: Instrument Cluster Control Module - J285- . Refer to appropriate repair manual. • CHECK: Outside Air Temperature Sensor - G17- harness connector terminal 1 to the Instrument Cluster Control Module - J285- harness connector T32 / 20 for resistance. • CHECK: Outside Air Temperature Sensor - G17- harness connector terminal 2 to the Instrument Cluster Control Module - J285- harness connector T32 / 19 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ TIP: The Outside Air Temperature Sensor - G17- may fail under loaded operation; please swap a known good Outside Air Temperature Sensor - G17- prior to continuing to the next step. ♦ GO TO: Step 4 ⇒ page 261 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 261 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Instrument Cluster Control Module - J285- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Instrument Cluster Control Module - J285- . Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return, the repair is complete. ◆ Return vehicle to customer.

3.6.28 Oxygen Sensor 1 After Catalytic Converter - GX7- , Checking

General Description

The Oxygen Sensor 1 After Catalytic Converter - GX7- is positioned downstream of the primary catalytic converter and it supplies the Engine Control Module - J623- with a voltage signal (nonlinear) indicating a "rich" or a "lean" condition is present. If the primary catalytic converter is supersaturated with oxygen (indicating a lean mixture is present), the Oxygen Sensor 1 After Catalytic Converter - GX7- will send the Engine Control Module - J623- a nonlinear signal indicating the lean mixture condition. The mixture is then enriched with fuel until the oxygen has been "displaced" from the catalytic converter. This new condition, in turn, is registered by the Oxygen Sensor 1 After Catalytic Converter - GX7- as a nonlinear signal indicating the rich mixture condition. The mixture is then leaned out by the Engine Control Module - J623- . If the nonlinear signal is received again, the mixture will again be enriched. The frequency, or period, during which the mixture is enriched or leaned out is variable, being dependent on the gas flow rate (engine load) at that moment.

Note the Oxygen Sensor 1 After Catalytic Converter - GX7- is also known as the Oxygen Sensor After Three Way Catalytic Converter - G130- .

The Oxygen Sensor 1 After Catalytic Converter - GX7- contains the following components:

- Oxygen Sensor After Three Way Catalytic Converter - G130- .
- Heater For Oxygen Sensor 1 After Catalytic Converter - Z29- .

The Oxygen Sensor 1 After Catalytic Converter - GX7- components cannot be serviced separately, and they must be serviced as a unit.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to Oxygen Sensor Preliminary Tests in ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 262 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- component connector terminals 3 to 4 for resistance. • SPECIFIED VALUE: 2 – 4 Ω (+/- 0.5 Ω @ 25° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 262 . – NO: ♦ REPLACE: Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 264 .
3	• IGNITION: ON. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 4 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 263 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 264 .

Step	Procedure	Result / Action to Take
4	• RECONNECT: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector. • CONNECT: Scan Tool. • START: Engine and let Idle. • Perform the function test located in Diagnostic Mode 06. Refer to appropriate Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, ⇒ “3.3 Diagnostic Modes 01 – 09 ”, page 19 . • IGNITION: OFF. • SPECIFIED VALUE: Mode 6 Pass. – Were Values obtained?	– YES: ◆ FAULT: Is intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 264 . – NO: ◆ GO TO: Step 5 ⇒ page 263 .
5	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • DISCONNECT: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 80 for resistance. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 59 for resistance. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 51 for resistance. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 5 to the Engine Control Module - J623- harness connector T94 / 58 for resistance. • CHECK: Oxygen Sensor 1 After Catalytic Converter - GX7- harness connector terminal 6 to the Engine Control Module - J623- harness connector T94 / 81 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Oxygen Sensor 1 After Catalytic Converter - GX7- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 264 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 264 .

Step	Procedure	Result / Action to Take
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return, the repair is complete. ◆ Return vehicle to customer.

3.6.29 Oxygen Sensor 1 Before Catalytic Converter - GX10- , Checking

General Description

The Oxygen Sensor 1 Before Catalytic Converter - GX10- does not actually measure oxygen concentration, but rather the difference between the amount of oxygen in the exhaust gas and the amount of oxygen in the air. A rich mixture causes an oxygen demand. This demand causes a voltage to build up, due to transportation of oxygen ions through the Oxygen Sensor 1 Before Catalytic Converter - GX10- layer. A lean mixture causes a low voltage, since there is an oxygen excess. The Oxygen Sensor 1 Before Catalytic Converter - GX10- and catalytic converters are used in order to reduce exhaust emissions. Information on oxygen concentration is sent to the Engine Control Module - J623- , which adjusts the amount of fuel injected into the engine to compensate for excess air or excess fuel. The Engine Control Module - J623- attempts to maintain, on average, a certain air–fuel ratio by interpreting the information it gains from the Oxygen Sensor 1 Before Catalytic Converter - GX10- . The primary goal is a compromise between power, fuel economy, and emissions. The heater for the Oxygen Sensor 1 Before Catalytic Converter - GX10- is designed to minimize the time-to-readiness for closed-loop operation by heating the Oxygen Sensor 1 Before Catalytic Converter - GX10- as quickly as possible.

The Oxygen Sensor 1 Before Catalytic Converter - GX10- contains the following components:

◆ Heated Oxygen Sensor - G39- .

◆ Oxygen Sensor Heater - Z19- .

The Oxygen Sensor 1 Before Catalytic Converter - GX10- components cannot be serviced separately, and they must be serviced as a unit.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to Oxygen Sensor Preliminary Tests in ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 265 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- component connector terminals 3 to 4 for resistance. • SPECIFIED VALUE: 2 – 4 Ω (+/- 0.5 Ω @ 25° C). – Was Value obtained?	– YES: ♦ GO TO: Step 3 ⇒ page 265 . – NO: ♦ REPLACE: Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to appropriate repair manual. ♦ GO TO: Step 6 ⇒ page 267 .
3	• IGNITION: ON. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 4 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 266 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 6 ⇒ page 267 .

Step	Procedure	Result / Action to Take
4	• RECONNECT: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector. • CONNECT: Scan Tool. • START: Engine and let Idle. • Perform the function test located in Diagnostic Mode 06. Refer to appropriate Diagnostic Mode 06 - Read Test Results for Specific Diagnostic Functions, ⇒ “3.3 Diagnostic Modes 01 –09 ”, page 19 . • IGNITION: OFF. • SPECIFIED VALUE: Mode 6 Pass. – Were Values obtained?	– YES: ◆ FAULT: Is intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 267 . – NO: ◆ GO TO: Step 5 ⇒ page 266
5	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • DISCONNECT: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 1 to the Engine Control Module - J623- harness connector T94 / 77 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 2 to the Engine Control Module - J623- harness connector T94 / 56 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 3 to the Engine Control Module - J623- harness connector T94 / 73 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 5 to the Engine Control Module - J623- harness connector T94 / 55 for resistance. • CHECK: Oxygen Sensor 1 Before Catalytic Converter - GX10- harness connector terminal 6 to the Engine Control Module - J623- harness connector T94 / 78 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Oxygen Sensor 1 Before Catalytic Converter - GX10- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 267 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 267 .

Step	Procedure	Result / Action to Take
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.30 Terminal 30 Power Supply Relay - J317- , Checking

General Description

The Terminal 30 Power Supply Relay - J317- is used to provide power to the Fuse Panel B - SB- , located in the engine compartment.

Special tools and workshop equipment required

♦ Multimeter.

♦ Wiring Diagram.

♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 268 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • DISCONNECT: Terminal 30 Power Supply Relay - J317- from the Fuse Panel B - SB- in the engine compartment. • IGNITION: ON. • CHECK: Terminal 30 Power Supply Relay - J317- socket terminals 30 and 86 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 268 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 269 .
3	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CONNECT: Jumper wire, between the Terminal 30 Power Supply Relay - J317- socket terminals 30 and 87. • IGNITION: ON. • CHECK: Engine Control Module - J623- harness connector T94 / 3, T94 / 5, and T94 / 6 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Were Values obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 268 . – NO: ◆ GO TO: Step 5 ⇒ page 269 .
4	• REMOVE: Jumper wire, between the Terminal 30 Power Supply Relay - J317- socket terminals 30 and 87. • CHECK: Terminal 30 Power Supply Relay - J317- socket terminal 85 to the Engine Control Module - J623- harness connector T94 / 69 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ REPLACE: Terminal 30 Power Supply Relay - J317- . Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 269 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 269 .

Step	Procedure	Result / Action to Take
5	• REMOVE: Jumper wire, between the Terminal 30 Power Supply Relay - J317- socket terminals 30 and 87. • REMOVE: Appropriate fuse (refer to appropriate wiring diagram for correct fuse). • CHECK: Downstream (output) side of Appropriate fuse to the Engine Control Module - J623- harness connector T94 / 3, T94 / 5, and T94 / 6 for resistance (refer to appropriate wiring diagram for correct fuse). • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ◆ REPLACE: Fuse Panel B - SB- fuse box. Refer to appropriate repair manual. ◆ GO TO: Step 6 ⇒ page 269 – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 6 ⇒ page 269 .
6	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ◆ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ◆ REPAIR: As necessary. ◆ If all electrical connections are OK: ◆ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ◆ Clear the DTC's. Refer to ⇒ “3.3.4 Diagnostic Mode 04 – Erase DTC Memory ”, page 24 . ◆ Repair is complete. Generate Readiness Code. Refer to ⇒ “3.2 Readiness Code”, page 17 . ◆ Return vehicle to Customer. – NO: ◆ Perform the diagnostic procedure for any DTC's. ◆ If no DTC's return, the repair is complete. ◆ Return vehicle to customer.

3.6.31 Three Way Catalytic Converter (TWC), Checking

General Description

A catalytic converter is a vehicle emissions control device that converts toxic pollutants in exhaust gas to less toxic pollutants by catalyzing a redox reaction (oxidation or reduction). Catalytic converters are used in internal combustion engines.

General recommendations

Oxygen sensors OK.

No leaks or damage to exhaust system.

Prior to repair work, perform a preliminary check to verify the condition. Refer to ⇒ “3.1 Preliminary Check”, page 16 .

Test requirements

- Fuses OK.
- Battery voltage OK.

- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	Activate Monitors: • Perform the function test in Diagnostic Mode 06. Refer to appropriate Diagnostic Mode 06 – Read Test Results for Specific Diagnostic Functions, ⇒ “3.3 Diagnostic Modes 01 – 09 ”, page 19 . • End diagnosis and switch the ignition off. • If the specified values are exceeded:	♦ Check the exhaust system for leaks. ♦ If necessary, repair the leak(s) in the exhaust system. ♦ GO TO: Step 2 ⇒ page 270 .
2	O2 Sensor Monitoring: • Erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 – Erase DTC Memory ”, page 24 . • Perform a road test to verify repair. • If the DTC does not return:	♦ Generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 17 . ♦ If no leaks are found in the exhaust system: ♦ Replace the catalytic converter with front exhaust pipe. Refer to appropriate repair manual. ♦ GO TO: Step 3 ⇒ page 270 .
3	• Final procedure: • Perform a road test to verify repair.	• After the repair work, the following work steps must be performed in the following sequence: • Check the DTC memory. Refer to ⇒ “3.3.3 Diagnostic Mode 03 – Read DTC Memory ”, page 23 . • If necessary, erase the DTC memory. Refer to ⇒ “3.3.4 Diagnostic Mode 04 – Erase DTC Memory ”, page 24 . • If the DTC memory was erased, generate readiness code. Refer to ⇒ “3.2 Readiness Code”, page 17 . • Return vehicle to Customer.

3.6.32 Throttle Valve Control Module - GX3- , Checking

General Description

The throttle valve operation occurs by an electric motor identified located within the Throttle Valve Control Module - GX3- . It is controlled by the Engine Control Module - J623- with primary inputs from the Accelerator Pedal Module - GX2- as well as other peripheral inputs.

Note the Throttle Valve Control Module - GX3- is also referred to as the Throttle Valve Control Module - J338- .

The Throttle Valve Control Module - GX3 / J338- contains the following components:

- Throttle Position Sensor - G69- .

The Throttle Valve Control Module - GX3 / J338- components cannot be serviced separately, and they must be serviced as a unit.

Special tools and workshop equipment required

- Multimeter.
- Wiring Diagram.
- Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ◆ GO TO: Step 2 ⇒ page 271 . – NO: ◆ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • CONNECT: Scan Tool. • IGNITION: ON. • CHECK: Throttle valve position closed: • SPECIFIED VALUE: 3 – 25%. • DEPRESS: Accelerator pedal slowly to WOT while observing the percentage display. The percentage display must increase uniformly. • CHECK: Throttle valve position at WOT: • SPECIFIED VALUE: 84 – 97%. • IGNITION: OFF. – Were Values obtained?	– YES: ◆ CONDITION: May be intermittent. ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 272 . – NO: ◆ GO TO: Step 3 ⇒ page 272 .

Step	Procedure	Result / Action to Take
3	• REMOVE: Throttle Valve Control Module - GX3- far enough so that the harness connector terminals are accessible. • DISCONNECT: Throttle Valve Control Module - GX3- harness connector. • IGNITION: ON. • CHECK: Throttle Valve Control Module - GX3- harness connector terminals 1 to 2 for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ♦ GO TO: Step 4 ⇒ page 272 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 272 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 3 to the Engine Control Module - J623- harness connector T60 / 30 for resistance. • CHECK: Throttle Valve Control Module - GX3- harness connector terminal 4 to the Engine Control Module - J623- harness connector T60 / 11 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Were Values obtained?	– YES: ♦ REPLACE: Throttle Valve Control Module - GX3- . Refer to appropriate repair manual. ♦ GO TO: Step 5 ⇒ page 272 . – NO: ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 5 ⇒ page 272 .
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

3.6.33 Vehicle Speed Signal, Checking

General Description

The Vehicle Speed Signal or VSS measures Transmission / Transaxle output or Wheel Speed from the ABS. The signal is

broadcasted over the CAN Bus. The Engine Control Module - J623- uses this information to modify engine functions such as ignition timing, A/F ratio, transmission shift points, and to initiate diagnostic routines.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in “P”.
- Vehicles with manual transmission, ensure the shifter lever position is in “N” with the parking brake applied.
- Observe all safety precautions: ⇒ “1.1 Safety Precautions”, page 2 .
- View clean working conditions: ⇒ “1.2 Clean Working Conditions”, page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ “3.1 Preliminary Check”, page 16 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 273 . – NO: ♦ GATHER more information from customer about the complaint.
2	• IGNITION: OFF. • CONNECT: Scan Tool. • ROAD TEST: Vehicle. • CHECK: Scan Tool to Speedometer for accuracy. • SPECIFIED VALUE: Difference ≤ 10%. – Was Value obtained?	– YES: ♦ CONDITION: May be intermittent. ♦ PERFORM: Visual Inspection of wiring and component. ♦ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ♦ REPAIR: Faulty wiring or connector. ♦ GO TO: Step 4 ⇒ page 274 . – NO: ♦ GO TO: Step 3 ⇒ page 273 .
3	• CHECK: ABS. • CHECK: ABS DTC’s. – Was the ABS OK?	– YES: ♦ CHECK: CAN Bus wiring from the Instrument Cluster Control Module - J285- to the ABS Control Module - J104- . ♦ GO TO: Step 4 ⇒ page 274 . – NO: ♦ REPAIR: Any ABS concerns 1st. ♦ GO TO: Step 4 ⇒ page 274 .

Step	Procedure	Result / Action to Take
4	• Final Procedure • Perform a road test to verify repair. • Do any DTC's return:	– YES: ♦ Check the DTC memory. Refer to ⇒ "3.3.3 Diagnostic Mode 03 – Read DTC Memory ", page 23 . ♦ Perform the diagnostic procedure for that DTC. – NO: ♦ Repair is complete. Generate readiness code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer.

3.6.34 Wastegate Bypass Regulator Valve - N75- , Checking

General Description

Both the boost and intake pressures are used to control the wastegate of the turbocharger. These pressure signals are supplied to the Engine Control Module - J623-, which then sends a pulse-width modulated signal to the Wastegate Bypass Regulator Valve - N75- . As a result, the Wastegate Bypass Regulator Valve - N75- controls the vacuum supply to the pressure unit, which directly acts on the wastegate via a connecting rod. This control system regulates the turbine speed and sets the maximum boost pressure.

Special tools and workshop equipment required

- ♦ Multimeter.
- ♦ Wiring Diagram.
- ♦ Scan Tool.

Test requirements

- Fuses OK.
- Battery voltage OK.
- Switch OFF all electrical and electronic accessories.
- Vehicles with automatic transmission, ensure the selector lever position is in "P".
- Vehicles with manual transmission, ensure the shifter lever position is in "N" with the parking brake applied.
- Observe all safety precautions: ⇒ "1.1 Safety Precautions", page 2 .
- View clean working conditions: ⇒ "1.2 Clean Working Conditions", page 4 .

Test Procedure

Step	Procedure	Result / Action to Take
1	• PERFORM: Preliminary Check to verify the customers complaint. Refer to ⇒ "3.1 Preliminary Check", page 16 . – Was Complaint verified?	– YES: ♦ GO TO: Step 2 ⇒ page 275 . – NO: ♦ GATHER more information from customer about the complaint.

Step	Procedure	Result / Action to Take
2	• IGNITION: OFF. • DISCONNECT: Wastegate Bypass Regulator Valve - N75- harness connector. • CHECK: Wastegate Bypass Regulator Valve - N75- component connector terminals 1 to 2 for resistance. • SPECIFIED VALUE: 5 – 25 Ω (@ approx. 20° C). – Was Value obtained?	– YES: ◆ GO TO: Step 3 ⇒ page 275 . – NO: ◆ REPLACE: Wastegate Bypass Regulator Valve - N75- . Refer to appropriate repair manual. ◆ GO TO: Step 5 ⇒ page 276 .
3	• IGNITION: ON. • CHECK: Wastegate Bypass Regulator Valve - N75- harness connector terminal 1 to ground for voltage. • IGNITION: OFF. • SPECIFIED VALUE: Battery voltage. – Was Value obtained?	– YES: ◆ GO TO: Step 4 ⇒ page 275 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 276 .
4	• REMOVE: Engine Control Module - J623- . Refer to appropriate repair manual. • CHECK: Wastegate Bypass Regulator Valve - N75- harness connector terminal 2 to the Engine Control Module - J623- harness connector T60 / 20 for resistance. • SPECIFIED VALUE: 0.5 Ω (± 0.3 Ω). – Was Value obtained?	– YES: ◆ TIP: The Wastegate Bypass Regulator Valve - N75- may fail under loaded operation; please swap a known good Wastegate Bypass Regulator Valve - N75- prior to continuing to the next step. ◆ GO TO: Step 5 ⇒ page 276 . – NO: ◆ PERFORM: Visual Inspection of wiring and component. ◆ CHECK: Wiring for open, high resistance, short or harness connector for damage, corrosion, loose or broken terminals. ◆ REPAIR: Faulty wiring or connector. ◆ GO TO: Step 5 ⇒ page 276 .

Step	Procedure	Result / Action to Take
5	• Final Procedure • Perform a road test to verify repair. – Does the original DTC return?	– YES: ♦ CHECK: Engine Control Module - J623- harness connector for any damaged, pushed-out pins. ♦ REPAIR: As necessary. ♦ If all electrical connections are OK: ♦ REPLACE: Engine Control Module - J623- . Refer to appropriate repair manual. ♦ Clear the DTC's. Refer to ⇒ "3.3.4 Diagnostic Mode 04 – Erase DTC Memory ", page 24 . ♦ Repair is complete. Generate Readiness Code. Refer to ⇒ "3.2 Readiness Code", page 17 . ♦ Return vehicle to Customer. – NO: ♦ Perform the diagnostic procedure for any DTC's. ♦ If no DTC's return, the repair is complete. ♦ Return vehicle to customer.

DAB 9-13-23 FB

Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Volkswagen retailer or other qualified shop. We especially urge you to consult an authorized Volkswagen retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Volkswagen.

- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.

- Volkswagen is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Volkswagen retailer parts department for the latest information.

- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the Volkswagen Factory Approved Scan Tool (ST).

- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.

- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.

- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it

- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.

- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.

- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.

- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.

- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.

next

Version 2.0

Cautions & Warnings

- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.

- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.

- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly; do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Volkswagen specifications. Makeshift tools, parts and procedures will not make good repairs.

- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.

- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.

- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.

- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.

- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.

- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.

- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.

- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).

- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Volkswagen Service technicians should test, disassemble or service the airbag system.

Version 2.0

Cautions & Warnings

- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.

- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Volkswagen Service technicians using the Volkswagen Factory Approved Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.

- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.

- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.

back OK

Version 2.0